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ABSTRACT

This manual was designed to provide the library manager or supervisor with a basic understanding of microcomputer hardware, software, procurement, and supervision. While developed for a summer workshop series, it can also serve as an introductory text. Separate chapters cover 10 major topics: (1) the microtechnology revolution; (2) how a microprocessor chip is made; (3) internal memories and data storage; (4) microcomputer bus standards and configurations; (5) peripheral devices; (6) software basics; (7) software development, requirements, and maintenance; (8) sources of information on the microcomputer hardware/software market, including microcomputer literature, technical reporting services, user groups, and vendors; (9) microcomputer management; and (10) management of the public access microcomputer program. Terms and operations are further explained with 16 illustrations. Appendices include a guide to the five types of microprocessors likely to be referenced by vendors, a 60-item bibliography, diagrams for interpreting hardware and software product literature, a schematic for reading a microcomputer hardware configuration, a list of computer clubs and microcomputer user groups, the ASCII character set, and a list of microcomputer publications. (LMM)

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MICROCOMPUTERS AND THE LIBRARY: A PLANNING GUIDE FOR MANAGERS

by
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Library Development Division
TEXAS STATE LIBRARY

May 1982

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INTRODUCTION

This workbook was designed to provide the library manager or supervisor with a basic understanding of microcomputer hardware, software, procurement, and supervision. While the workbook will act as an integral part of the Texas State Library Summer 1982 workshop series, MICROCOMPUTERS AND THE LIBRARY, it can also be used independently as an introductory text. Many topics presented in abbreviated form in the workbook will be discussed at length during the workshops and readers who are using the workbook alone are encouraged to supplement this document with readings listed in the bibliography.

It is important to remember that the technology of microcomputers is in a state of almost constant change. For this reason, some materials presented in this workbook will probably be outdated by the year 1984 and it is up to the reader to use this workbook as only a starting place, constantly reviewing the professional literature for new trends and opportunities of how the microcomputer can best perform in the library environment.

THE MICRO TECHNOLOGY REVOLUTION

During the early 1970s, the electronics industry in the United States experienced a significant technological revolution. This revolution was the refinement of the design, manufacture, and use of microelectronic circuits, commonly called microprocessor chips. The use of these chips by businesses and general consumers is continuing to grow and expand. It is estimated, for example, that if AT&T were to rely on human operated telephone connections, instead of microprocessor driven telecommunications switching, the work force necessary to operate the system would require the entire U.S. female population between the ages of 18 and 45.

Because of the advances in microprocessor manufacture using a photographic process instead of a mechanical assembly process, the time necessary to design and implement the manufacture of a new computer circuit was significantly reduced from a period of several years to as little as 6 months, as described below.

1. Definition of chip architecture	1 to 2 months
2. Circuit design and testing	1 to 2 months
3. Software development	2 to 3 months
4. Processing/manufacture procedures	2 to 3 months
Total Development Time	6 to 10 months *

This ability to respond to custom circuit design needs made it possible for many more manufacturers of consumer and computer products to continually expand and improve their products. A good example can be seen in the experiences of the calculator industry from 1970 to 1980. In 1971, the Sharp Electronics Corporation marketed a four function calculator (add, subtract, multiply, and divide) for $395.00. Eight years later, in 1979, the same company released a ten function caluclator at a retail cost of $10.95. This was accomplished due to a tremendous drop in the price of custom manufactured microprocessor circuits. The unit cost of computing transactions continues to drop and it is predicted that this trend will continue through the 1980's.

Costs of 100,000 Computations

1952	$ 1.26
1958	0.26
1964	0.12
1970	0.05
1975	0.01
1985	0.005 *

It is predicted that at the end of the 1980's, technological innovations in the design and manufacture of microprocessor circuits will have hit a peak and cease to improve at such alarming rates. Once this technological saturation point has been reached, developers will most likely begin to look to new industrial opportunities, such as more advanced software development, which will continue to

improve performance in the microprocessor industry and market. The microprocessor will continue growing as a more important part of everyday life, and easier for all types of consumers to use and enjoy.

*Source: McGlynn/Microprocessor Technologies

HOW A MICROPROCESSOR CHIP IS MADE

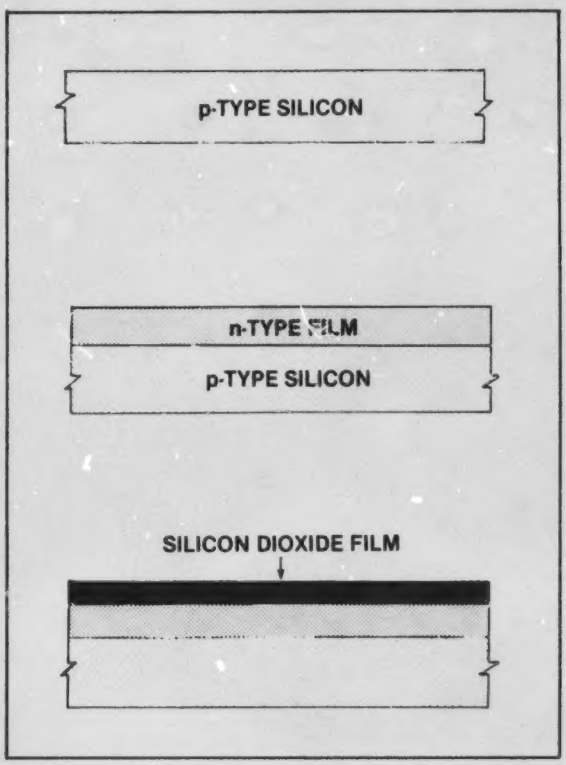
One of the important components which has contributed to the inexpensive cost of computing power is the integrated microprocessor chip. Unfortunately, many lay persons, librarians included, view this as an almost magical process. The actual process of chip manufacturing is quite straightforward and easily understood. Presented in this section is a simplified explanation of how a chip is made. By gaining insight into this one aspect of microprocessor manufacture technology, the reader will better appreciate the reasons that computing power has grown so fast and why microcomputers will continue to grow in numbers and popularity.

Chips are manufactured using a substance called silicon. Silicon was selected because it can conduct electricity, like other metal crystals, and is easy to make and control in a manufacturing operation. Silicon has another important feature useful in the process of chip making. By adding extra electrons to the crystal or removing electrons from the crystal, the silicon can be made to either conduct electricity or not conduct electrictity. This allows the manufacturers to control patterns of electrical flow, just as if wires were used, by changing the electron properties of small adjacent areas of the silicon crystal.

Step 1. The process starts with the creation of pure silicon wafers, approximately 3 inches in diameter, using a process similar to that used in the production of other crystal substances, such as rock candy. These silicon wafers are then 'doped' loaded with p-impurities, a lack of electrons in the crystal.

Step 2. The silicon wafers are loaded into ovens, exposed to hot gases (2000+ degrees), which results in the deposit of a film of n-type silicon film on the wafer.

Step 3. The wafers are then exposed to an oxygen based gas which results in a film of silicon dioxide on top of the n-type silicon film. The wafer now has three layers of silicon based substances, each layer having different electrical conducting property.



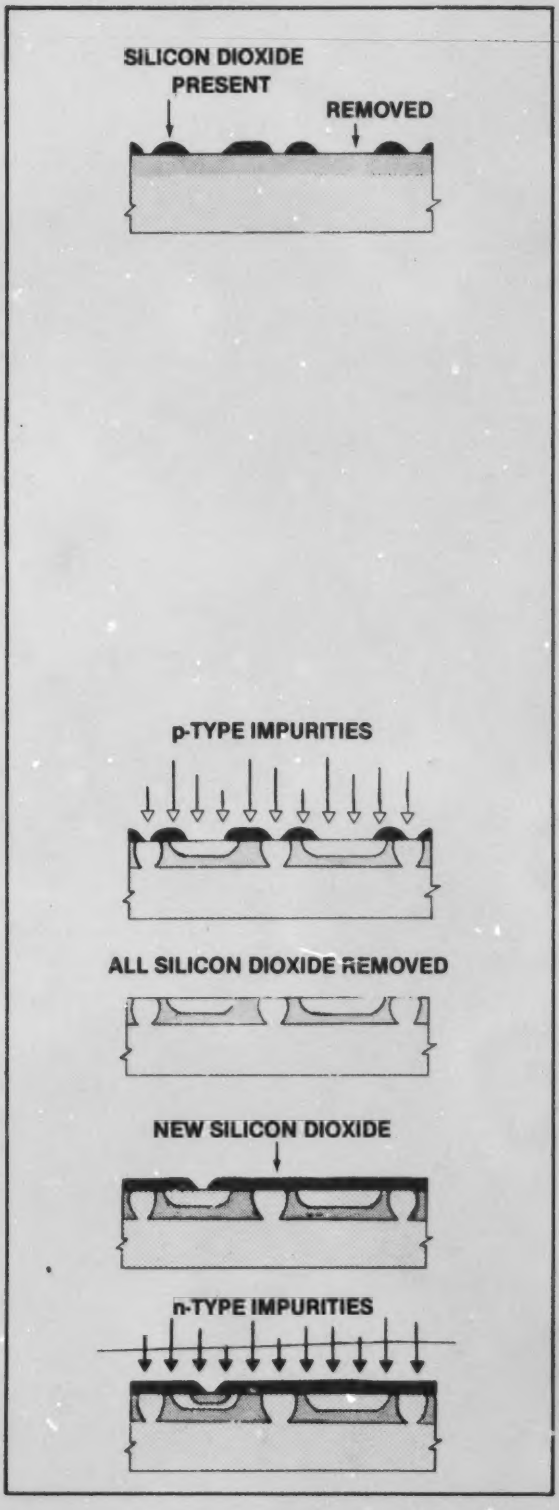
Step 4. The circuit designer has prepared drawings of all of the electrical channels and switches (similar to electrical wires) which should be embedded in the chip. This drawing is repeatedly reduced, using photographic techniques, until it is the same size as the silicon wafer. The drawing is placed on the wafer and exposed to ultraviolet (UV) light. Where there are lines on the reduced version of the drawing, the UV light is blocked from hitting the silicon dioxide layer. Where there is space between the lines of the drawing, the UV light hits the silicon dioxide layer and hardens the substance. The wafer is removed from the light and washed with chemicals. What remains are small lines whereever the UV light hit the silicon dioxide and small valleys exist where the silicon dioxide was washed away.

Step 5. Now that the wafer has small windows peeking through the top layer of the silicon wafer, the wafer is exposed to gases which create a shortage of electrons in the middle layer of the wafer, whereever the small windows are present.

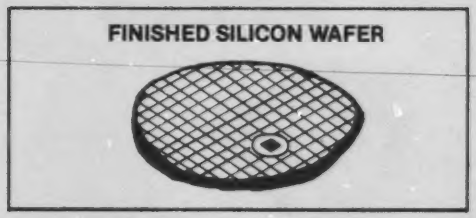
Step 6. The series of channels and windows of silicon dioxide are removed, leaving the wafer with two layers, the top layer having various sections of p-type and some sections of n-type.

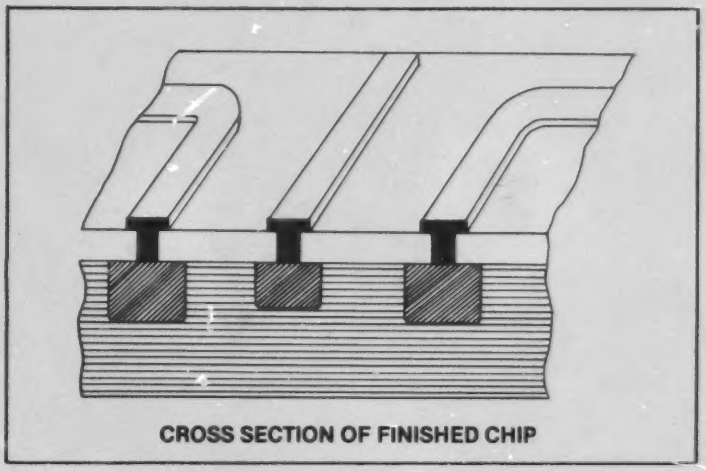
Step 7. The surface is again covered with silicon dioxide, exposed to ultraviolet light, and small channels and windows are formed.

Step 8. This time extra electrons are passed through the windows changing the properities of the second layer of silicon to n-type where ever a window is present.

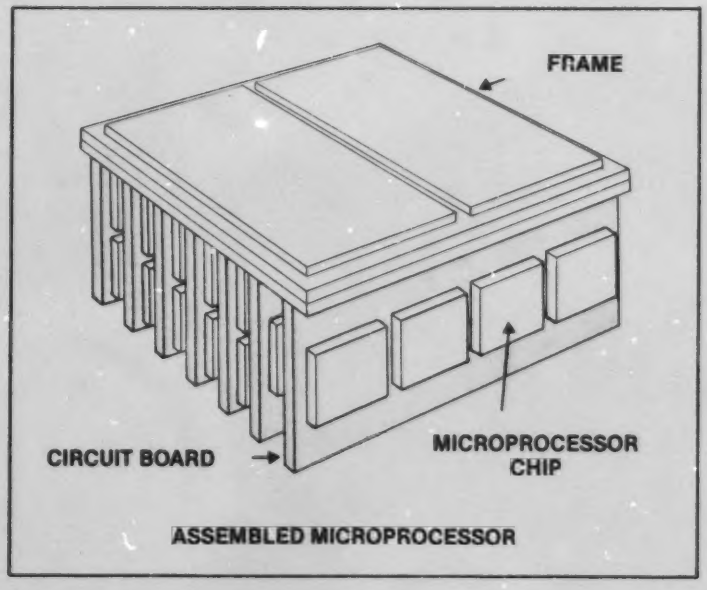

SILICON DIOXIDE
PRESENT
REMOVED
p-TYPE IMPURITIES
ALL SILICON DIOXIDE REMOVED
NEW SILICON DIOXIDE
n-TYPE IMPURITIES

Step 9. This photo-engraving process continues until all of the various drawings are put on the chip in the multiple layers. The chip is then covered with an aluminum outer covering and the chip is completed.





From this point the microprocessor finished chips are assembled by attaching the chips to circuit boards and circuit board frames. After these connections are tested, the microprocessor is read for assembly in the device is was designed to support.

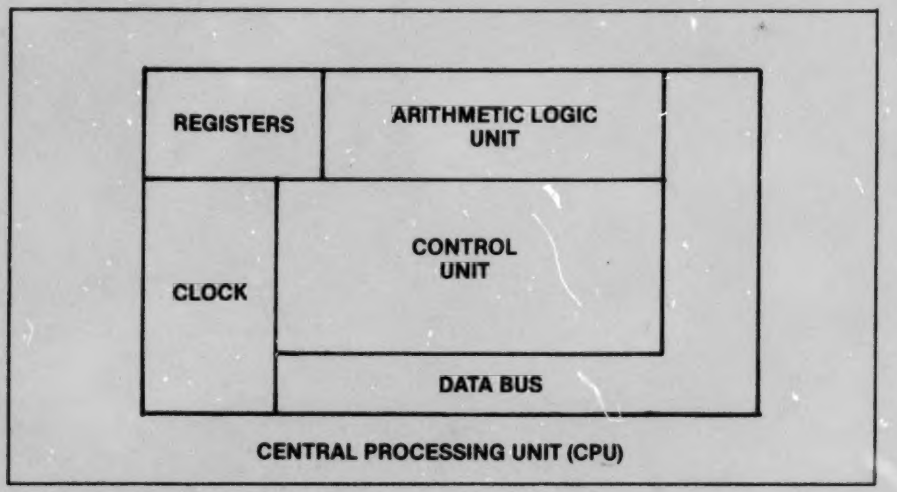


INTERNAL MEMORIES AND DATA STORAGE

The heart of the microcomputer is composed of the central processing unit (CPU) and the internal memories. All functions are performed by microprocessors. Each microprocessor, however, is designed differently to accomplish certain specific tasks. The cooperative completion of tasks by the various microprocessors produces the desired results, whether the task is to add numbers, sort names, or circulate books.

CENTRAL PROCESSING UNIT.

The central processing unit is composed of microprocessors which perform all calculations and decision making. The CPU is made of of a number of different microprocessor functions.



Arithmetic and Logic Unit. This is the area of the CPU where all arithmetic calculations take place. Logic, such as sorting or examining the value of a particular data field, is also performed by this series of microprocessors. This unit has only the ability to receive information and make a decision or calculation with the information provided. If the decision made at step A is then to be used in making the decision at step B, the arithmetic/logic microprocesor has no place to store the result of A which will be used in step B. For this reason, a special type of circuit is added to the microprocessor, called the accumulator, which stores values needed for an additional calculation. The accumulator acts as a scratch pad for calculations and sorting.

Registers. These are microprocessors which, like the accumulator, store information. The more registers that a CPU has, the faster calculations can be performed since information is readily available. The number of registers varies from machine to machine.

Control Unit. The control unit is simply a microprocessor with responsibility for transfering information to and from the registers and to the arithmetic/logic unit, etc. The control unit also directs what information flows in and out of the CPU for processing. The control unit 'controls' and coordinates the actions of the CPU microprocessors.

Microcomputer Clock. This is a special processor chip which is responsible for timing all actions taken in the CPU. The clock sends regularly timed electrical pulses through the entire computer device signaling the various steps to take place. On most microcomputers, the clock pulses at a rate between 2 and 4 million times per second.

Data Buses. These are special microprocessor chips which transfer data in and out of the CPU.

MEMORIES.

Memory devices store information, long or short term, which the computer needs to carry out a particular function. There are two categories of memory.

1. Internal Memory. This is a series of microprocessors which store a limited amount of information needed by the CPU to perform calculations or sorting type functions.

2. External Memory. This is the storage medium for large amounts of information not readily needed for processing and is usually contained on a peripheral device. Microcomputers depend on floppy disk, cassette tapes, and hard disks for most external memory storage of data. These are decribed in more detail in subsequent sections.

Internal Memory.

Microcomputers have different amounts of internal memory. Generally speaking, the more internal memory that a microcomputer has available for processing support, the faster that processing can take place. This is because the computer must continually travel back and forth to get information from the external memory devices when it is not possible to store all the information needed in the internal memory. The way in which internal memory is measured and referenced is by how many characters can be stored at any given time. For example, if 1 microprocessor can store 1,024 characters of information (called bytes), and if the microcomputer owned by the library has 4 internal memory microprocessors, the computer has 4,096 characters of internal memory. Since the storage capacity of a given microprocessor is expressed in numeric values which do not end in even numbers, computer enthusiasts have developed jargon which is commonly used to measure the various increments of both internal and external memory storage capacities.

1K =	1,024 bytes	16K =	16,384 bytes
2K =	2,048 bytes	32K =	32,768 bytes
4K =	4,096 bytes	64K =	65,536 bytes
8K =	8,196 bytes	128K =	131,072 bytes

Microprocessors are manufactured, with very few exceptions, in increments of 2K quantities. For for this reason that you will not find machines with 35K, 9K, etc. internal memories. For a review of the various technologies of internal memory microprocessors, see Appendix 1.

MICRO BUS STANDARDS AND CONFIGURATIONS

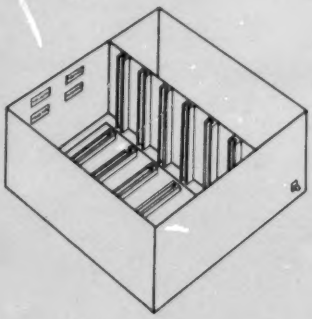
One of the factors which should be carefully investigated by the library when purchasing microcomputer equipment is its abilit, to be upgraded. The library should select a microcomputer which can expand in memory resources and peripheral devices as new needs and applications are discovered. In looking for upgrade flexibility in the hardware, two basic questions should be asked:

1) How many expansion board interface slots, for either memory or peripheral device upgrades, are available ?

2) Of these upgradeable interface slots, what bus configuration is required ?

Inventory of the Available Upgrade Interface Slots. In order to answer the first question, inventory the number of interface and expansion slots that the microcomputer provides. Examining the product technical literature or the equipment itself should make this possible.

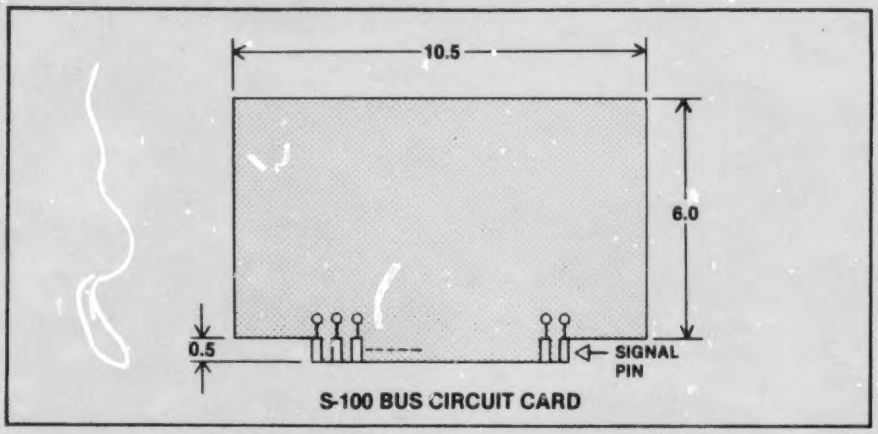
Before any peripheral devices or additional memory can be added to the microcomputer, a microprocessor board (memory expansion board or controller board for peripheral devices) must be plugged into one of the expansion slots. Obviously, if there are no expansion slots available, it is not possible to add a microprocessor board which will allow the addition of game paddles. If, however, there are 4 expansion slots available, the controller for the game paddles can be added and the microcomputer would then have 3 remaining expansion slots.



MICROCOMPUTER UPGRADE SLOTS

The best way to inventory the number of slots available, and any restrictions on their use, is to prepare a schematic diagram of each microcomputer being seriously considered. This process is described in Appendix 5. After all diagrams have been prepared, it will be relatively easy to define and compare each type of equipment in terms of expansion opportunities.

Determining Bus Configurations for Interface Slots. If a particular microcomputer does have a sufficient number of empty expansion slots, verify that the expansion microprocessor boards and the open slots are hardware compatible. Compatibility is determined when the expansion microprocessor board and the open slot have the same 'bus configuration'. By 'configuration' we mean the size and shape of the circuit card on which the microcomputer chips are mounted. The 'bus' is the number, size, and location of the various signal pins which fit into the open slot devices. Unfortunately, the microcomputer industry has not standardized one special type of bus configuration which all manufacturers use. For this reason, not all expansion cards will fit into all machines.



S-100 BUS CIRCUIT CARD

S-100 Bus Configuration. The S-100 bus configuration is so common and widely used that it is a de facto industry standard. Most of the hardware and software on the market is designed to operate on computers which use the S-100 bus. The IEEE Computer Society Microprocessor Standards Committee was organized to adopt standards which will likely be identical to the S-100 design because of its wide popularity. Consider a microcomputer which uses the S-100, or is at a minimum S-100 compatible. The principle advantages of using a S-100 technology machine are:

1) Independence. There are eight different manufacturers of microprocessor boards (6809,6802,6800,6502,8080A,8085,2650, and Z80) which are designed to be compatible with the S-100 bus. No other bus offers this variety of computer architectures.

2) More available hardware support. There are many more manufacturers of plug-in expansion boards (in excess of 100) which are S-100 bus compatible, offering the widest choice of expansion options.

3) More computing power. The S-100 bus provides the most computing power in a variety of computer architecture areas, including, I/O ports, memory addressing, data transfer rate, etc.

4) Most software available. There are many times more applications software, operating systems, and computer languages for the S-100 than for any other microcomputer system.

LSI-11 Bus Configuration. This is a bus configuration, very different and not compatible with the S-100 bus, developed by the Digital Equipment Corporation. This type of bus card and all LSI-11 microprocessor cards can only be used in LSI-11 type computers and the Heath H-11 system. The expansion boards which use the LSI-11 technology tend to be higher priced than the S-100 bus expansion options.

Multibus Configuration. The Multibus was developed by the Intel Corporation for use in 8080/8085 microprocessor systems only. As with the LSI-11, this expansion equipment tends to be higher in cost than the S-100 type expansions.

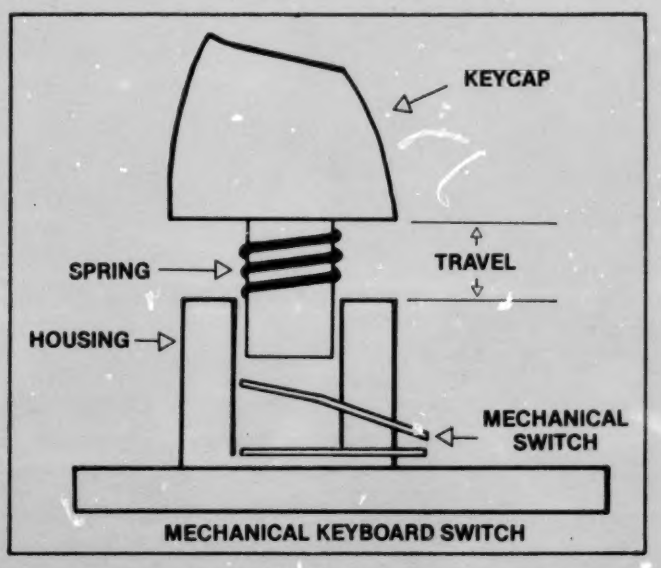
PERIPHERAL DEVICES

KEYBOARD

The keyboard is the most common input device used in microcomputing. The keyboard usually comes completely assembled and without negotiable options, unlike many of the other microcomputer components. There are important differences in the way that keyboards are designed and how they operate; differences which should be considered carefully in the selection of the microcomputer.

Keyboard Switch Technologies

The primary purpose of the keyboard device is to capture individual keystrokes from the operator and transmit these values for processing by the computer. This process of capturing individual keystrokes is accomplished by a special technology called 'keyboard switch technology'. In examining any microcomputer, acknowledge the type of keyboard switch technology used. Each of the five different switch types has a 'life cycle', a predicted maximum number of keystroke depressions that it is designed to withstand before malfunctioning should occur. This can be important for the library microcomputer since it will most likely receive more use than the average hardware operated by a hobbyist or professional.



MECHANICAL KEYBOARD SWITCH

Mechanical Switch: This is the least expensive of switch devices and uses a plunger type mechanism which results in a metal to metal contact. Life cycle of 8-10 million cycles.

Reed Switch: Also a mechanical switching device, the Reed switch uses metal rods (reeds) packaged in an airtight substance. This prevents environmental damage to the switch. Life cycle of 80-100 million cycles.

Capacitance Switch: Capacitance is a noncontact switch which uses plates, which when shifted, causes a change in electrical charge called a change of capacitance in the line. Life cycle of 100+ million cycles.

Hall Effect Switch: Like the mechanical switch, the Hall Effect Switch uses a plunger action mechanism which, when the key is depressed, moves a magnet within range of a Hall effect transducer. This transducer receives a shift of magnetic charge and generates an electrical signal. Life cycle of 80+ million cycles.

Saturable Ferrite Core Switch: Similar to the Hall effect switch, the Core switch uses a magnet attached to the key cylinder in the plunger device. Periodically each second, pulses are send to the ferrite core base of each key switch device. If the key has not been depressed, the magnet on the plunger inhibits (by saturating with magnetism) the key from responding; if however, the key has been depressed, the ferrite core cannot be saturated by the magnet and sends an electrical charge indicating the keystroke.

In selecting the keyboard device, be particularly careful about microcomputers on which you plan to allow users to play video games. These games usually make heavy use of certain individual key switches for particular actions in the game, such as 'space bar' for FIRE MISSLES.

Rollover Interpretation

A very important consideration in the selection of a keyboard is rollover interpretation, how the keyboard interprets two or more key switches which are hit at the same time. On the IBM Selectric I typewriter, when two keys are depressed simultaneously, the character '-' (dash) is displayed. Because of memory storage in the keyboard mechanism itself, computer terminals and electronic typewriters have two basic methods of handling rollover:

2-Key Interpretation: This method Can interpret only when two keys are pressed simultaneously. The memory stores both keystrokes and assumes that the first keystroke released is keystroke the operator intended to depress first. If more than two keystrokes are depressed, the excess keys do not usually register.

n-Key Interpretation: This keyboard device has a much larger memory and can store 3 or more keystrokes (up to n keystrokes as indicated by the manufacturer). It also assigns keystroke order by the sequence in which key switches are released by the operator.

Keystroke Automatic Repeat

This type of keyboard contains special microprocessors which allow the operator to simply depress certain keys and the keystroke will be repeated until the operator releases the key switch. This is particularly helpful to libraries in preparing documents which require underlining, etc.

Special Character Abilities

Some keyboards have overlays which allow the same key switches to represent many hundereds of different characters. For example, in the cataloging process, some terminals have special microprocessor boards which can understand the Cyrillic alphabet or Japanese pictorial characters. The operator sends a special message to the

microprocessor indicating which special character set is desired, places an overlay (cap pictures) over the keystroke caps, and then using the same key switches produces entirely different characters. To date, this is not found in microcomputers but will probably be added when the consumer market requests it in large numbers.

Keystroke Programmability

Programmability of key switches allows the operator to perform many, sometimes thousands, of special operations with a single keystroke. This procedure is accomplished in two ways:

Pad Function Keys: Some keyboards have keys designated as 'PF1', 'PF2', etc., or whatever the individual manufacturer uses as an abbreviation. The programmer assigns a complete program, a long sequence of instructions, to be performed whenever the operator depresses the PF type key.

User Programmable: This describes the process of the user instructing a particular 'program' type key to perform some specific task for a temporary period of time. The operator turns the key 'ON' by depressing the key one time, then proceeds to actually perform the desired procedure on the keyboard. When the procedure is complete, the 'program' key is depressed a second time turning it 'OFF'. From this time forward, whenever the program key is hit, it 'remembers' the keystrokes the operator performed and duplicates them.

CRT TERMINAL

The CRT, cathode ray tube, type terminal is the most common and popular device used with microcomputers to display information. First commercially introduced by IBM in 1965, the CRT is simply a television type tube which uses microprocessors to assist it in displaying characters, graphics, or color images. There are two types of CRT devices:

CRT Terminal. This device includes the cathode ray tube, keyboard device, and can contain limited memory microprocessors. This type of terminal is used primarily with larger computer systems.

Video Monitor. Many microcomputers do not require the use of a CRT terminal device. Direct video output is provided by the connection of the microcomputer to a television or video monitor, eliminating the need for the more expensive full CRT. The keyboard device is included in the microcomputer mechanism when using this type of hardware configuration.

The microcomputer industry no formal standard for how many characters should be displayed on a CRT screen, but most terminals are designed to have 24 lines of 80 characters each (1920 characters). Some microcomputers, such as Apple, have less display area than this de facto standard. These microcomputers can, however, be upgraded to a larger display area by adding additional microprocessors

CRT devices are reliable and cause few problems to the average user. They should be positioned on a sturdy table at a recommended height of 26 inches, the same as a typewriter stand. Work space is needed on at least one side of the CRT terminal and if located in an area which is carpeted, anti-static mats should be used. When adjusting the brightness (intensity) of the characters, avoid settings which are in the 'high' ranges which will damage or 'burn', the CRT tube mechanism. Burning has taken place when the CRT is off and shadows and spots are visible on the tube backing where displays remain fixed for extended periods of time.

When locating the CRT in the library, face the CRT screen away from bright lights and windows. Screens are subject to distracting glare and this interferes with efficient use. Should glare result from all angles, glare screens and shields are available from microcomputer suppliers.

Some CRT terminals have microprocessors which allow special types of displays on the screen. Dual intensity screens display characters at two levels of brightness. For example, an operator outlines a form in high intensity and enters data onto the form in regular intensity. The other primary special feature offered on some terminals is the process of reverse video projection. Instead of white characters on a dark background, the background is altered so that characters are dark on light intensity background.

CASSETTE STORAGE

Audio cassette tape storage devices are one of the most popular storage mediums for microcomputers. Until recently, tape storage was accomplished on high fidelity tape machines connected to the microcomputer. More recently, new magnetic tape systems have been introduced on the market which are intended solely for use with microcomputers and use 1/4 or 1/2 inch tape, similar to large data processing tape machines.

The primary reason that this storage method has and continues to be so popular is the low cost, both for the cassette machine and the cassette tapes. When properly maintained, the cassette storage method is very reliable and easily transportable from one microcomputer to another. The principle disadvantage to using cassette storage is the relatively slow speed of operation. For example, if a 60-minute tape cassette is used to store a long application program, it will take approximately 25-30 minutes for that program to be read and stored into the computer memory. This is about 10 times slower than magnetic disk storage.

A newer technology using the magnetic tape medium is the cartridge backup system, designed for use with hard disk drives. These tape devices are designed specifically for computer storage and bear little resemblance to high fidelity cassette recorders. Each tape cartridges can hold approximately 40+ million characters of information. Microcomputers read tape cartridges at approximately 12 minutes per cartridge. While the performance of this type tape system is far superior to high fidelity type cassette storage, the cartridge devices are very expensive and out of the reach of most hobby or professional microcomputer users.

Care of the Cassette Storage Device

The primary problem of cassette storage devices is improper use and maintanence. The following guidelines should prevent the majority of difficulities encountered when using this storage method.

1) Where possible, avoid the use of traditional high fidelity tapes in the machines. Special 'data tapes' are manufactured specifically for use with computers and these tapes will produce better results for the average user. Data type tapes have no leader, the tape has a thinner chromium dixiode coating specifically designed to store higher digital frequencies, and the mechanical cassette parts are of a higher quality than high fidelity tapes. If 'data tapes' are not readily available, use the higher quality high fidelity tapes, such as Maxell-UD or TDK-AD.

2) Do not use 'long-play' type cassettes. Cassettes of the 30 or 60 minute variety are reliable, but 90 or 120 minute cassettes are subject to tape stretching.

3) Tape machine drive heads and rollers should be cleaned at regular intervals, preferably after 10-12 hours of use.

4) Tapes should be wound at a uniform and moderate speed. Avoid the layering of tapes, a process where the tape is only partially used, played and then rewound only part way through the tape. This results in different tension levels on parts of the tape spool.

Special Tape Storage Problems

When supervising a microcomputer program which uses cassette tape storage devices, be prepared to encounter and correct the following types of common tape related problems.

Print Through. This is the loss of the data or program stored on a magnetic tape due to magnetic seep. The problem is caused by the casette being wound too tight, usually by the fast rewind facility, and being stored for an extended period of time without use. Because of the tight wind, the magnetic charges seep through the tape layers and alter magnetic qualities on the tape. Particularly discouraging to users, only some portions of the tape may be affected but, depending on the data, the entire tape might be unusable.

Tape Cinching. This is the ripple or bunching effect within the spool of tape, resulting from the tape being wound at different speeds at different locations of the tape. Once this occurs, the tape can be damaged by tape stretching or slipping of feeder runners and of scraping the sides of the cassette cartridge.

Dirt Contamination. This is a result of poor care of the equipment and the use of inferior cassette tapes. Dust and lint collect in the read/write mechanisms of the tape machine damaging both machine and cassette tapes. The use of poor quality cassette tapes results in a buildup of chromium dixoide on the read/write head, again potentially damaging the equipment and interfering with proper performance.

Variations in Tape Speed. This is usually caused by slipping belts or improperly balanced pressure rollers in the cassette machine. It can also be a sign that tape stretching has occured.

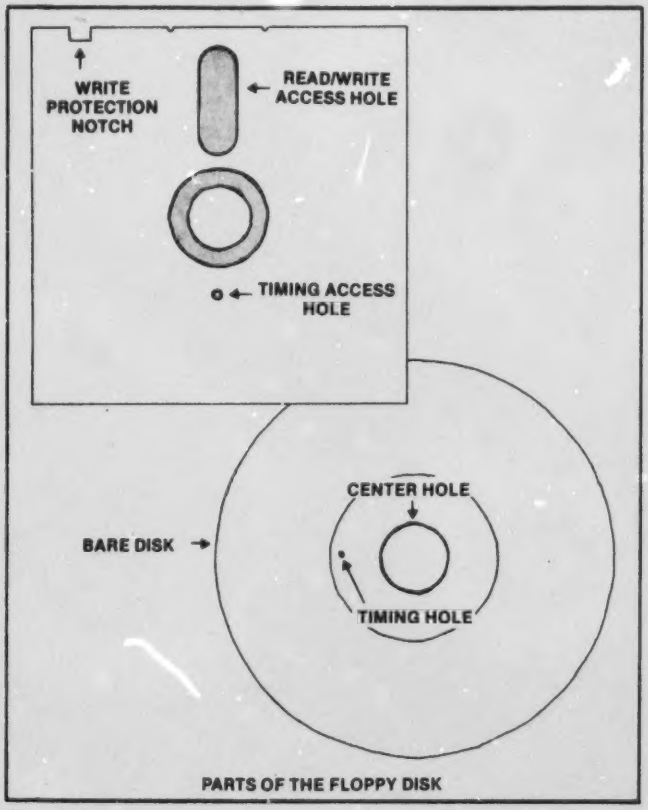
Azimuth Alignment. This is the result of an azimuth effect, an arching or improper contact between the read/write mechanism and the magnetic tape as it travels through the rollers. It is usually resolved by simply adjustments.

FLOPPY DISK STORAGE

The floppy disk is now the most popular external storage medium for microcomputers. More application software is available on floppy disk than on any other format. Floppies are also the primary cause of all computer failure problems. By studying the proper use and handling of the floppy disk and disk drive mechanism, 75% of all computer failures can be avoided.

Understanding the Floppy Diskette

Parts of the Diskette. Floppy diskettes come in two standard sizes, 8 inches (floppy) and 5 1/4 inches (flippy). It is made of a mylar disk 0.005 inches thick which is coated on both sides with oxide to form a magnetic sensitive surface. The mylar oxide disk is covered with a plastic pad filter and then encased in a protective envelope. The protective envelope has several special features. First is an oblong hole, called an access hole, which allows the read/write head on the disk drive mechanism to make contact with the mylar diskette. The timing hole allows the disk drive to locate and monitor how the disk is located when reading or writing actions are to occur. On one of the envelope edges will be a write protection hole. The purpose of the protection hole is to prevent the accidental damage of information stored on the diskette. On the 8 inch diskettes, protection is automatically envoked when the hole is uncovered; 5 1/4 inch flippies are protected when the hole is covered. Upon close examination, you should find two small notches located below the access slot. These alignment and strain relief notches are used by the drive mechanism to secure the disk firmly during read and write actions, preventing the disk envelope from shifting as the mylar disk is rotating at 300 revolutions per minute.

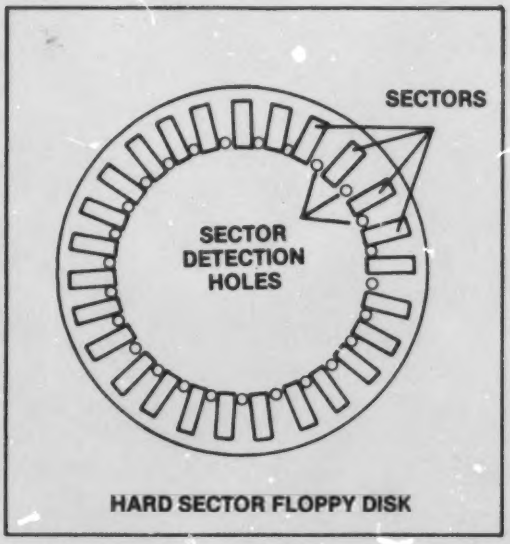


PARTS OF THE FLOPPY DISK

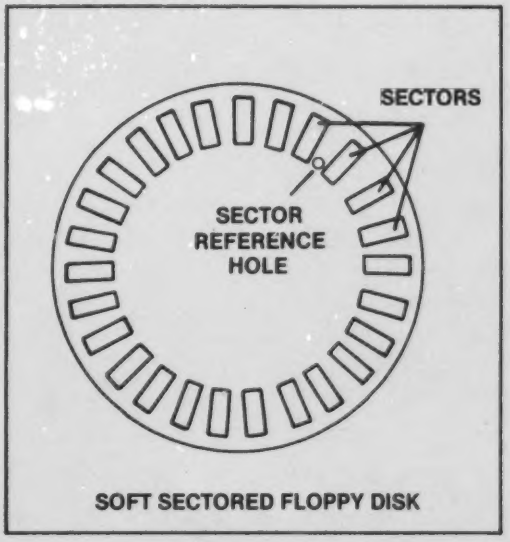
Disk Certification. At the time of manufacture, diskettes are examined to verify that no flaws exist in either the oxide coating or the construction of the protective envelope. This is the process of certifying the diskette. Depending on the disk purchased, some are certified for only one side of the diskette while others are cer-

tified on both sides of the diskette. It is recommended that only certified diskettes be used in the library microcomputer program.

Diskette Tracks and Sectors. Most diskettes are divided into concentric rings called 'tracks'. Since each of the tracks are a different distance from the center hole, each track has a different amount of space on which to store information increasing in size as they progress from the center hole. Since varying track sizes would be difficult for the disk drive to manage, the tracks are subdivided into equal numbers of characters. These subdivisions are called sectors. On most diskettes, there are 128 characters in each sector. [Since the varying sizes of tracks cannot always be divided equally among 128 character sectors, there is some wasted space on the diskette; this excess, however, allows the system to perform more efficiently.]



HARD SECTOR FLOPPY DISK



SOFT SECTORED FLOPPY DISK

There are two ways diskettes indicate the location of sectors to the disk drive mechanism. Hard sectored diskettes exibits a ring of small holes around the center of the diskette. Each hole physically represents the location of a new sector. Soft sectored diskettes have only one hole near the center of the diskette. Before soft sectored diskette can be used, the microcomputer system, using the one hole as a reference point, marks off the location of each sector using magnetic charges. Once this process,called formating, is accomplished the disk drive can locate the various sectors in relation to the one small hole.

Densities of Storage. When diskette technology was first introduced to the market, information could be stored on only one side of the diskette and at 128 characters per sector. With the growth in demand for increased storage capabilities, manufacturers responded by increasing the storage options available on floppy diskettes.

Single-sided Single-density: This is the original technology where information is stored on only one side at a rate of 128 characters per sector.

Single-sided Dual-density: This is a more advanced technology where twice the number of characters are 'packed' into each of the sectors, at a rate of approximately 256 per sector. Since the sectors don't change in size, it is advisable to have a higher quality diskette. Dual density type diskettes are coated with a thicker magnetic oxide surface which permits a better 'hold' of the tightly packed magnetic characters.

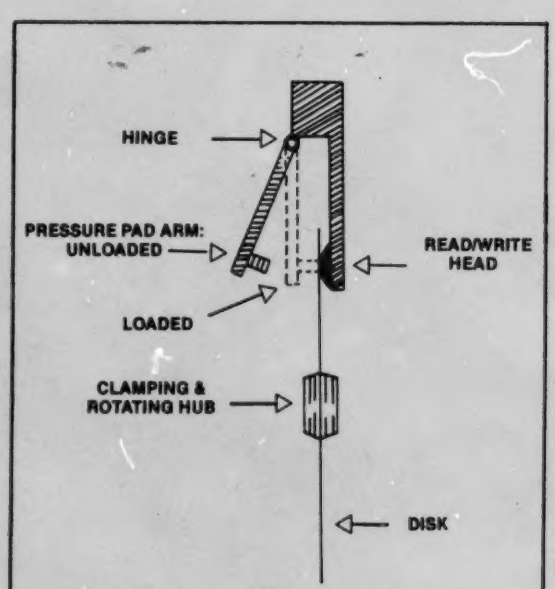
Dual-sided Dual-density: Called 'quad-density', this is the most recent floppy disk technology designed to store information using dual density on both sides of the magnetic coated mylar diskette.

Disk Drive Mechanism

The floppy disk drive mechanism has several important components: disk controller, disk drive mechanism, and disk drive cable. It is important to understand the function and relationship of each of these devices to properly use and maintain the disk storage functions on your microcomputer.

Disk Controller. The disk controller is a microprocessor based circuit board which controls all actions of the disk drive mechanism and the communications between the disk drive and the central processing unit. Usually located in the microcomputer case (as opposed to the disk drive casing), one disk controller can usually control the actions of more than one disk drive mechanism. The controller board is designed to accomodate either single or dual density storage on diskettes and care must be taken to acquire the proper type of controller mechanism during procurement of the system. This component usually requires little, if any, maintenance by library staff.

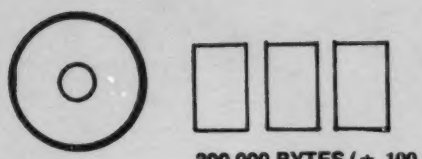
Disk Drive Mechanism. This mechanism has several important components with which all users should become familiar. The read/write head is a small ceramic disk with an embedded sensing device which moves across the mylar diskette and 'reads' or 'writes' magnetic charges on the oxide surface. Most disk drives are intended for single sided operation and have only one read/write head. Dual-sided disk drives have two read/write heads which perform the magnetic transactions simultaneously on both sides of the disk. The clamping-rotating hub is the center device in the drive which grabs and spins the mylar disk during operation of the disk unit. The pressure pad arm presses one side of the mylar



FLOPPY DISK LOADED IN DISK DRIVE

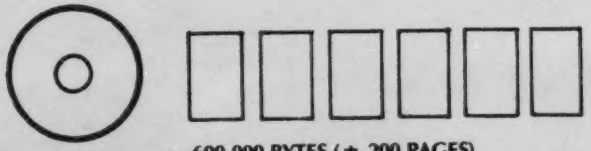
DISK DENSITY TECHNOLOGIES

SINGLE SIDED
SINGLE DENSITY



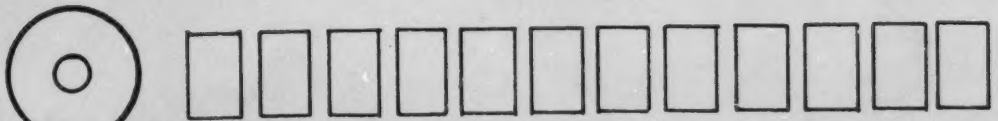
300,000 BYTES (± 100 PAGES)

SINGLE SIDED
DUAL DENSITY



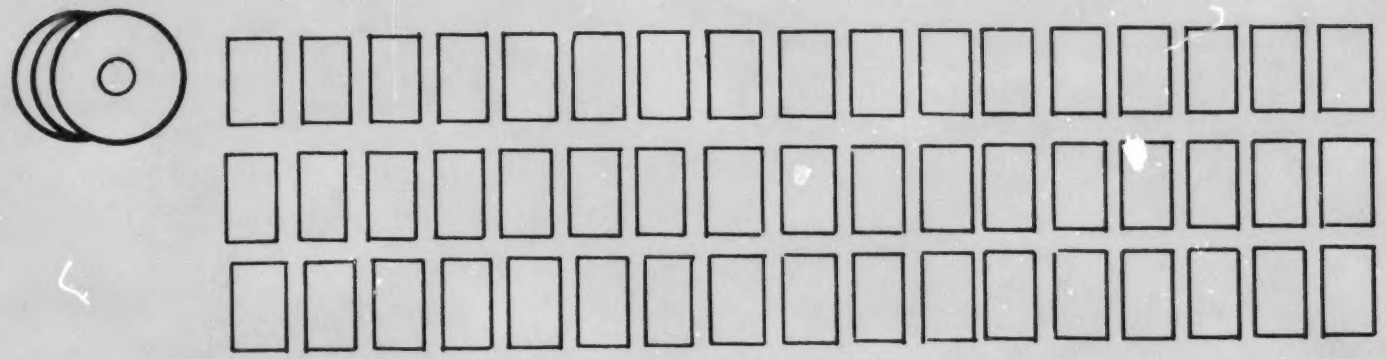
600,000 BYTES (± 200 PAGES)

DOUBLE SIDED
DOUBLE DENSITY
[QUAD DENSITY]



1,200,000 BYTES (± 400 PAGES)

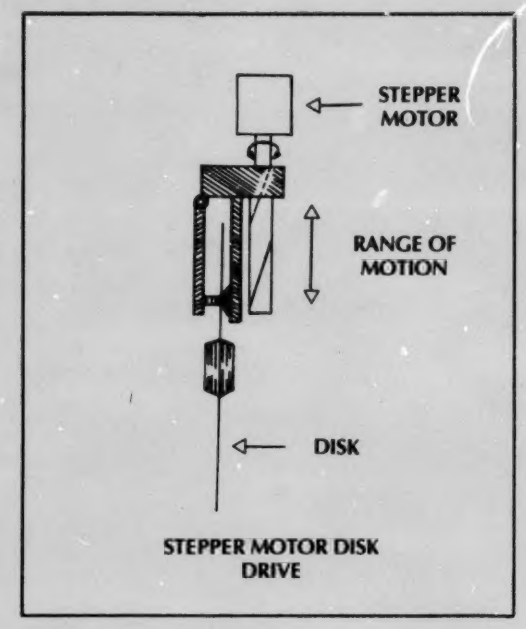
WINCHESTER
HARD DISK
TECHNOLOGY



5,000,000 + BYTES (± 1,650 PAGES)

= 33 TYPEWRITTEN PAGES

diskette close to the read/write head. When the pressure pad is lifted from the diskette surface, the read/write head cannot transmit magnetic charges to the diskette. Lastly, the stepper motor is the mechanism which moves the read/write head back and forth across the surface of the diskette, allowing it to reach all sectors os the disk.



STEPPER MOTOR DISK DRIVE

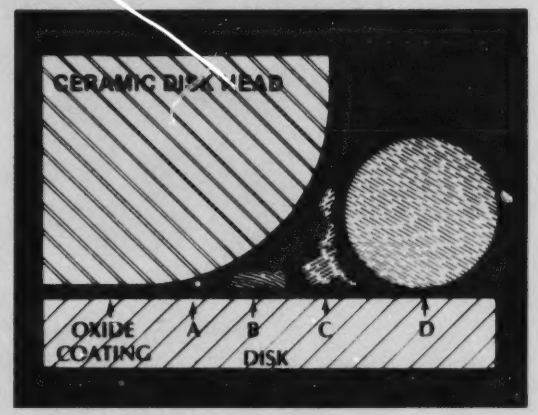
Disk Drive Cable. This is a package of wires, encased in plastic, which connects the disk drive mechanism to the disk controller board. If this cable is not properly attached to both devices, the disk drive cannot operate.

Preventing Head Crashes and Diskette Destruction

Most problems encountered in using diskette storage are the result of damage to the ceramic read/write head and/or diskette. Virtually all of these situations occur as a result of improper use of the equipment or lack of proper care and maintanence of the diskettes. Library staff may encounter the following types of problems.

Dirt. The most common of cause of problems with disk storage is the accumulation of dirt, lint, and grease on the surface of the diskette, which is eventaully passed during use to the disk drive mechanism. In some cases, a particle of dirt becomes jammed between the mylar diskette surface and the cermanic read/write head. This scrapes the oxide surface off of the diskette and sometimes permanently damages the ceramic head. It is very important to prevent the accumlation of dirt, lint or grease (resulting from the hands of the operator), on the diskette. Human hair (.005 inches) is frequently the cause of head crash damage to diskettes.

Static Electricity. The buildup of static electricity which, when a charge is actually generated, can cause the magnetic information stored on a diskette to change. When microcomputers are located in an area which is carpeted, anti-static mats should be placed under the workstation furniture. Operators should never clean or wipe the surface of the CRT while the machine is on and certainly never when the disk drive is engaged. Static charges frequently occur when diskettes are stacked together, even when they are housed in protective covers. As a general rule, do not stack diskettes.



PREVENTING DISK CRASHES AND DATA LOSS

A - SMOKE PARTICLE
B - FINGERPRINT
C - DUST PARTICLE
D - HUMAN HAIR

Extreme Temperature Variations. Diskettes are subject to damage when exposed to temperatures falling outside the range of 50-120 degrees F. In the lower temperature ranges, the magnetic oxide coating becomes brittle and is subject to chipping. Temperatures in excess of 120 degress cause diskettes to warp and curl, making proper operation in the disk drive impossible. Avoid the location of any type of microcomputer in direct sunlight.

Improper Insertion of the Diskette. Always insert the diskette with the read/write access slot toward the front as the diskette is inserted. Never insert a diskette into the system before it is turned on, or power off a system while a diskette is resident in the drive. This process of powering on and off frequently causes electrical surges which may inadvertently write garbage on the diskette, damaging valuable information.

Improper External Care of the Diskette. The most frequent cause of diskette destruction is careless handling by the operator. Never bend a diskette. Never write on the protective envelope with a hard surface pen or a pencil. Never place a metal clip or clamp on the edge of the diskette protective envelope. Never expose the diskette to magnetically charged devices, such as paper clip holders, etc. The placement of a diskette near a telephone frequently results in damage to the diskette, caused by the electromagnet used as part of the telephone buzzer mechanism. Never attempt to clean the mylar surface of a diskette. Never place or store a diskette in areas with heavy chemical fumes such as photocopy chemicals, correction fluid, nail polish, etc. Always store diskettes in protective covers.

Preventive Floppy Diskette Maintenance

To insure maximum performance of the disk storage equipment, the following general maintenance guidelines should be implemented:

Care and storage of diskettes should be performed as described in the previous discussions.

Disk drive heads should be cleaned regularly to eliminate dust. The frequency with which they should be cleaned depends on the amount of use, but it is recommended that libraries clean the disk drives at least twice annually. Special kits are available to assist in this task and under no circumstances should chemical solvents such as alcohol be used.

Care must be taken to examine the potential damage which book theft detection devices will have on diskettes. While most types of x-ray devices will not harm the magnetic fields, close contact with devices which are used for book detection can cause changes in magnetic qualities.

If diskettes are allowed to be taken from the library setting, or mailed, they should be securely housed in a rigid container which is completely waterproof. It is not advisable to allow the removal of library diskettes from the library microcomputer area.

HARD DISK STORAGE

Hard disks are most commonly used in larger business applications where millions of characters of external storage are necessary. There are many library administrative activities, such as circulation or cataloging, where it would be essential to store data on a hard disk. For this reason, a brief discussion of the hard disk options for the library will be examined.

Understanding the Hard Disk

The hard disk shares many of the same design and performance characteristics as the floppy disk. As is implied by the name, the hard disk is a non-flexible platter, usually made from aluminum, which is covered by magnetic oxide. This platter can operate alone, or several platters may be packaged together and form a disk pack. Most hard disks are encased in a protective cover which is almost air tight and therefore more resistant to dirt and dust.

Hard disks rotate at a very high speed, usually between 2000 - 2500 revolutions per minute. The disk travels at approximately 55 - 60 miles per hour. Very different from the floppy disk, the hard disk read/write head(s) do not come into direct contact with the hard disk surface. The heads travel on a thin cushion of air close enough that magnetic charges can be exchanged, but not close enough to make direct contact. Should the read/write head ever come into direct contact with the disk, a head crash will result. For this reason hard disks are carefully controlled and housed in a monitored environment. When hard disk crashes occur the results are difficult to repair and expensive.

Like the floppy disk, hard disks are divided into tracks and sectors. The diameters of hard disk platters vary from approximately 5 1/4 to 12 inches, and most hard disks are now sold as disk packs. Disk packs usually contain either 5 platters (20 - 80 million characters) or 12 platters (100 - 300 million characters). It is doubtful that the library will be able to afford the latter hard disk configuration. These are intended primarily for large systems, such as minicomputers and main frame systems.

Hard disks are available in two formats:

1) Removable Cartridges. These are usually single platter disk systems where the disk cartridge can be removed from the disk drive. This is similar to the floppy disk system in that only those disks currently being used remain in the disk drive. When the disk cartridge is no longer needed, it is removed and another cartridge inserted. These cartridge systems can either be front or top loading, depending on the manufacturer.

2) Disk Packs. Disk pack systems can also be removed from the disk drive system. As described previously, these systems usually contain 5+ disk platters and are intended for use with larger systems.

3) Winchester Disks. These disk devices, introduced in 1978, are designed for the smaller micro systems. They are primarily non-removable disk platters sealed in an airtight casing. These disk platters are usually 5 1/4 or 8 inches in diameter. Since the disks are not removable, backup is the primary problem with the Winchester systems.

PRINTERS

Of all devices related to the operation of the microcomputer, the printer has the largest number of mechanical parts and is, therefore, the most subject to failure and periodic maintenance. The predicted rate of failure depends on the quality of the printer and the rate of use. For example, a professional person who uses a high quality printer two hours per day can anticipate one major failure per year. A library, on the otherhand, with 6-10 hours of use daily, should expect maintenance of the printer on monthly or bimonthly basis.

Types of Microcomputer Printers

Two primary technologies of printers are used with microcomputers.

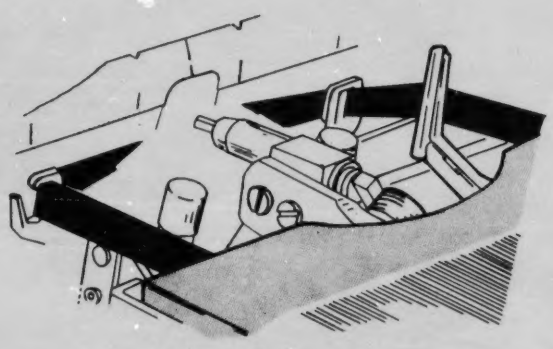
Impact Printers

These printers mark the character on paper by using a raised letter element which strikes an inked ribbon transfering the image to paper. Several different types of impact printers are commonly used with microcomputers:

Daisy Wheel. This printer uses a flower like element with each petal of the element containing one character. Daisy wheel printers are moderate to expensive in price and can operate at speeds from 15 to 60 cps (characters per second).

Thimble. The thimble, or golf ball, printer uses a roundish typing element similar to those found in IBM Selectric typewriters. Like the daisy wheel technology, these printers are moderate to expensively priced and can print at a rate of approximately 20 to 60 cps.

Dot Matrix. Dot matrix printers are very different from impact printers. Rather than using a detachable typing element, the dot matrix has a typing head composed of a series of slender metal rods organized in a rectanglar matrix. When the printer is instructed to type and 'a', the rods which form the 'a' strike against the printer ribbon and form the outline of the desired character. The rod patterns come in two sizes, 5 x 7 rods or 7 x 9 rods. The more rods per character that the printer has, the better the quality of character produced since more rods will leave less white space on the paper. Some matrix printers can print different type styles, but this ability is contained in the printer microprocessor boards, not in the printer strike



DOT MATRIX STRIKE HEAD

head mechanism. The dot matrix printer ranges in cost from very inexpensive to very expensive. It has a wide variance in printing speeds, 30 to 400 cps, depending on the quality of print desired.

Non-impact Printers

These printers use a technology which produces printed characters without striking the paper. Except for thermal printers, most of these technologies will not be within the price range of the library. One major limitation to nonimpact printers is the inability of most types to make multiple copies.

Thermal. Thermal printers have a typing head, similar to a matrix printer, which passes heat through the metal rods burning the character instead of striking a ribbon. This type of printer usually requires a special type of paper and cannot use ordinary bond or cotton rag paper. Thermal printers are very inexpensive and vary greatly in speed.

Electrostatic. Like thermal printers, electrostatic printers burn the characters on the paper. A particular problem with some brands of printers which use electrostatic processes is a shelf life on the special paper which they require. Even after the printing takes place, the image seems to fade from the paper over time as the physical properties of the paper change.

Ink-Jet. Ink jet printers are a newer and more sophisticated technology. Instead of using a print head type element, the printer has small sprayers which accurately spray the ink onto paper in the shape of the desired characters. This type is printer is very fast and very expensive.

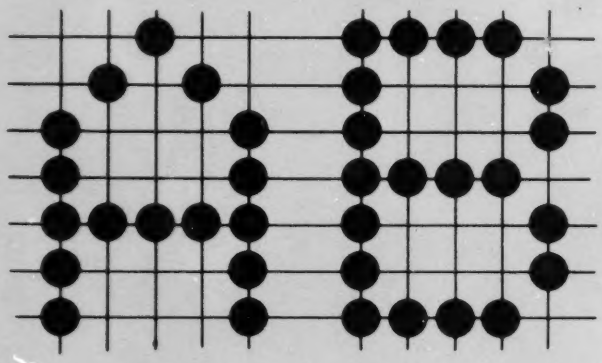
Laser. This printer has similiarities with both the ink-jet printer and the thermal printer. Like the ink-jet printer, the laser has no print head but uses a small laser head. Like the thermal printer, the laser burns the characters onto the paper, but unlike the thermal, does not require special paper in which to operate correctly. This is currectly the most expensive type of printer on the market and can print thousands of pages per minute.

Special Printer Characteristics

When selecting a printer, it is important to look for a technology which will serve the library users. It is also important to select a brand of printer which has some of the features which might be of use to the special applications run on the library microcomputers.

Print Quality. Print quality varies depending on the type of printer selected. Generally, quality is described as 'letter' or 'executive' quality, indicating fully formed characters which are similar in quality to that of a typewriter. Matrix type printers have a lower quality image. While this may be fully acceptable for most applications, if the library plans to use software heavily dependent on printed output, such as word processing, a letter quality printer is recommended.

Upper/Lower Case. When selecting a dot matrix type printer, the library should seek out a brand which uses the 7 x 9 matrix, instead of the 5 x 7 matrix, if applications require the printing of both upper and lower case letters. The 5 x 7 matrix produces an inferior quality lower case letter set.



DOT MATRIX 5 x 7 CHARACTER PATTERN

Character Sets. A character set is the different types, not styles, of characters that a particular printer is capable of printing. For example, listed in Appendix 7 are each of the characters which form the ASCII character set. Most printers are not capable of printing full character sets, and should you require a special set, such as the ALA character set, it is quite possible that while the characters could be stored on disk, the printer might not have the capability to print them out.

Character Print Styles. Print styles refer to the varying shapes of a particular character. On most impact printers, character design types can be altered by simply changing the typing element, from 'letter gothic' to 'italic' for example. In order to change the character set on a dot matrix machine, the microprocessor printer controller must have the various style of characters you want produced. This 'program controlled' character ability is found only on the more expensive machines and the ability to alter character size and shape varies widely from machine to machine.

Overstrike Capability. This is the ability for the printer to perform two separate strike actions at each character position. For example, if a word is to be underlined or a particular character bolded (hit twice to make a darker impression), two strikes by the printer must take place. The less expensive printers usually do not have this capability.

Super/Subscript Printing. This is the process where the printer roller has the ability to adjust 1/2 line up or down as the characters are being printed. For example, when printing a line which needs an elevated footnote number to be printed, the printer will roll down by 1/2 line, print the character, and resume its proper position. Superscript refers to printing slightly elevated above the print line while subscript indicates placement of the character 1/2 step below the typing line.

Proportional Spacing. This is a process where the printer advances the print head machanism a different distance depending on the size of the character. For example, the space needed to print an 'i' is much less than to print a 'w'. The printer would make allowances for these character sizes differences and allow the operator to put more information on a single page, without that page looking crowded.

Special Printer Problems

Most problems with printers can be avoided if the machine is regularly serviced and properly maintained. The library manager should prepare to encounter the following as rountine printer problems.

Paper Jams. Paper jams are the most frequent problem with the printer. Jams are usually cause by operator error, such as,

a) Improper print commands. The operator instructs the printer to perform actions beyond its physical limitations. For example, margins are set at 140 characters when the printer has a maximum width of 95.

b) Misuse of the tractor feed device. Many printers use continuous feed paper and pin feed printer attachment. If the attachment is connected incorrectly or paper tension between pin tracks is too tight, paper will jam in the machine.

c) Incorrect initial feeding of paper into machine rollers.

Paper jams can be both dangerous and expensive. Some printers are not sophisticated enough to recognize the paper jam taking place and will continue to attempt operating. This usually causes overheating and sometimes results in burned out microprocessor boards. It is generally not good practice to leave printers unattended.

Damage to Roller Platten. Many printers cannot detect when they have run out of paper. This usually results in the printer continuing to print, striking the roller platten. This can destroy the roller.

General Eratic Behavior. This is the situation where the printer may operate without problems at times and with difficulty at other times. This is usually the sign of a microprocessor board which is about to burn out, a poor connection between the microcomputer and the printer, or a software problem in the application program being used.

Ribbon Related Problems. Many printer problems are caused by poor quality ribbons. It is recommended that libraries purchase ribbons that of high quality. Lightly tap the ribbon case on the corner of the printer table before inserting into the machine. This frequently relieves the ribbon spool from any residual plastic shavings which might remain after assembly of the ribbon casing.

Broken Printer Elements. Impact printers frequently experience broken typing elements. This most frequently occurs when the element is not properly secured into position before printing begins. When purchasing elements, by in quantities of 2+ each style. This protects the library from having an element break in the middle of a long print stream and having to either reprint or wait for the replacement element.

SOFTWARE BASICS

Software is a generic term describing all types of computer programs. The many types of computer software can be grouped into four basic categories: computer operating systems, programming languages, computer utilities, and application programs.

Operating Systems

The operating system is the control program responsible for management and allocation of internal computer resources such as internal memory. It also coordinates the storage and retrieval of information from disk and tape devices; opens and closes data files; and performs important maintenance functions such as full disk duplication, a procedure used to protect important data by creating a backup copy. The manner in which this control program operates on a particular computer system can take two different forms:

ROM Controlled: The specific management procedures and practices used by this form of operating system are stored permanently in ROM (Read Only Memory) microprocessors. The ROM processor is automatically activated when the computer power is turned on. This type of operating system is found primarily in hobby microcomputers and programmable calculators.

User Loaded: Like the ROM controlled systems, microprocessors are resident in the microcomputer hardware and activated when the computer power is turned on. These ROM microprocessors are extremely limited in the tasks they are able to perform. Before the system can operate to its full potential, the full operating system must be loaded into RAM (Random Access Memory) microprocessors from an external device such as a diskette or cassette tape. Once this procedure is completed, the system is fully equipped to operate until the microcomputer is turned off, after which the loading procedure must be repeated. The advantage of this type of operating system is its flexibility. As improvements to the software are made, new diskettes or cassette tapes can be distributed, allowing all users to continually update the operating system without requiring a change in the hardware devices.

Programming Languages

Programming languages are software programs which translate instructions into a format that the machine can understand. This is completely a convience to the programmer in allowing the preparation of instructions understandable to a human which are altered by the programming language into a form which can be accepted and processed by a machine. Computer programs are written in either assembly language or high level languages.

Programming Languages

Machine Level	Assembler	High-Level
010000011100	Mov 14	C = A + B
011000011111	Add 15, 13	
011001000000	Sto 12	
110100011011	Num 01, 13, 09	

Assemblers

The microcomputer can recognize only two values, 0's or 1's. By using a combination of these two digits, in the form of binary numbers, instructions can be expressed to the computer in what is called machine-language. Since writing a long sequence of program instructions with binary numbers would be extremely difficult and time consuming, symbolic meanings for these instructions were devised to assist the programmer in communicating with the computer. These mnemonics (memory aids) are used to instruct the computer how to complete a specific task. Using assembler syntax, or mnemonics, is the fastest computer language when the program is executed. Few non-computer specialists use assembler, however, because the language requires more training and refined programming skills than the higher level languages.

High Level Languages

High level computer languages include the most popular programming languages, such as BASIC, COBOL, FORTRAN, etc. Unlike assembler, the high level languages are designed to make the process of writing computer program instructions less complicated. This is accomplished by having the language syntax represent the task to be accomplished. For example, the process of addition can be expressed in BASIC language by stating " LET A + B + C = Z". For most high level languages, there are two alternate procedures by which the tranlation can be made from language syntax to machine-readable code.

Interpreter. This process translates and executes the program lines from high level syntax to machine-code one line at a time. The advantage of this approach is that changes or corrections to the program involve only replacing single words or lines of the program. The disadvantage is the requirement that the interpreter software must reside in memory at all times which reduces space available for the application program. In addition, since the program must be interpreted every time the program is run, the operation of the program is slower than the compiler alternative.

Compiler. The compiler requires that a series of separate steps be completed before the program can be executed.

1) The programmer prepares a list of the program statements in the high level language syntax.

2) The instructions are received by the microcomputer using a compiler program called the 'editor'. The editor examines each instruction as it is received from the programmer and verifys that each statement submitted is permissible. If not, corrections are made by the programmer. Once an edited version of the program is complete, it is stored out on disk or cassette tape and is called the 'source program'.

3) Once the source program is in place, the compiler examines each instruction and creates a corresponding machine-language instruction in another file resulting in the 'object program'. Two versions of the program are now stored on the system; the source program and the object program.

4) When the programmer is ready to execute the program, the proper signal is given to the system, such as 'RUN'. [The exact execution command varies from system to system.] After receiving the command, the operating system loads the object program into memory and immediately executes the program. This is much faster than the interpreter method since the program is already in machine-level language. If the program needs to be modified, however, the programmer must alter the source program statements to the correct format and re-compile the program before it can be executed.

Computer Utilities

Computer software utilities are special programs frequently needed by many different computer users to perform a special task. Most often, utilities are written in assembler language, are extremely complicated program designs, and are far beyond the capabilities of most programmers. Unlike application programs, which can also be quite complicated, utilities usually work in cooperation with the operating system to perform some service or maintanence type function which in itself is not the end product. The following types of computer utilities will probably be of the most use to library staff and public computer users.

Sort Utility

This is a program which allows the user to sort information stored on a disk in some special order, which the user can designate. For example, if a library staff member has a list of 5000 names and addresses stored randomly on a disk, using the sort utility these addresses can be rearranged into anotner order without the intervention of the user. The utility could be instructed to arrange the address file:

1) in ascending order by zip code,

2) within common zip codes, in descending order by street,

3) and within common streets, ascending order by name.

Some sort utilities also offer a printing option whereby the addresses could be sorted first, then the information printed out, one address at a time, by some designated order different from the address arrangement on the file.

Data Base Management Systems (DBMS)

A DBMS allows the user to perform very sophisticated manipulation of data, as the name implies. The user carefully defines the manner in which the data will be stored in the data base, ie. (1) Name, (2) Address, (3) City, etc.. The user also designates Name or (3) City, for example. At a later time, the user can designate a search key, (3) City, and supply a value for that search key, such as 'Washington, D.C.'. The DBMS then instantaneously retrieves all of the addresses which have the city 'Washington, D.C.'. It is not necessary for the user to know how the DBMS stores and keeps track of the locations of information on the disks, these functions are transparent to the user. This type of software utility is very powerful and usually expensive. Features of DBMS systems by different software developers are very different and the user is warned to investigate the procurement of the DBMS with great care. It is potentially the most expensive software product the library will ever purchase.

File Management Utilities

File management utilities combine selected features from both sort utilities and data base management systems. As implied by the name, this software is designed to assist the user in building, sorting, moving from one disk to another, copying, and indexing files; groups of data or information. Less expensive than either sort or DBMS software, file management systems take care of the average user with basic maintenance needs, not requiring sophisticated sorts or multiple indexes for each file.

Application Software

Application programs describes the software packages, either purchased or developed inhouse, which perform some specific task or service for the user which is the end product. Examples would include word processing, mailing list generators, video games, income tax software, accounting systems, or the many library oriented software packages recently introduced to the market such as catalog card production or item absent circulation systems.

Library Software

There is a great deal of confusion about the availability of library oriented software for microcomputers in the general marketplace. Most of of the automated systems reported in the literature are larger, comprehensive software systems developed and marketed by companies specializing in library automation, such as CL Systems, GEAC, etc. Most of these companies rely on larger computers, such as mini or mainframe processors, and rarely can be installed for amounts less than $75,000.00 -$100,000.00. Some library software packages are beginning to be field tested and marketed to libraries. Reaction to the programs has been mixed. Many librarians are happy to have less expensive microcomputer based software to assist in the performance of certain library tasks. Others have criticised microcomputer based software applications as being incomplete and simplistic in addressing the needs of the modern library environment.

Many of these complaints are accurate. Much of the microcomputer software being developed for, and many times, by libraries is poorly designed, tested, and documented. This type of software should be condemned and avoided. There is an emerging body of micromputer software designed for use by libraries which is of good quality and should be considered for certain library environments. Much of the confusion with this software lies in the unrealistic ways in which it is evaluated. For example, a micro software package intended to capture circulation transactions and print overdue notices cannot, and certainly should not, be compared to the circulation systems produced by the major library automation vendors. Obviously, there is no way a software package costing $150.00 can compare to a system costing 100+ times that amount. Many libraries are setting unrealistic goals in looking to microcomputers to automate procedures only possible on larger and more sophisticated machines. Library software should be reviewed and evaluated with this in mind.

In looking for microcomputer software for the library, there are currently two types of software designs available.

Single Function Library Software. This category includes software that is intended to perform one specific function. This might include programs which type book labels, produce overdue notices, or perform A-V scheduling. These types of programs can usually operate on most of the microcomputers used by libraries and are reasonable in price ($25.00 - $150.00). This category of software dominates the existing software market and is quickly expanding.

Integrated Function Library Software. As the larger library automation systems move to the 'integrated' concept, so move microcomputer software developers. With the availability of hard disk storage, a small number of companies have recently introduced software systems which allow the user library to perform a number of different library tasks (cataloging, acquisitions, circulation, etc.) using one central file of data. These systems are significantly more expensive than the single function software and require a larger committment from the library, both in equipment and staff training.

Integrated Microcomputer Software Systems

There are currently two firms marketing an integrated library software system for the microcomputer. A brief description of each is described below. [It should be noted that the purpose of this workbook is to notify the reader of the existance of available software packages applicable to the library environment. A listing of software in this and subsequent sections is not an endorsement of the software and should not be interpreted by the reader as a recommended purchase. Each library should be contact software developers and should only consider procurement after carefully establishing software functional capabilities within the context of that individual libraries' needs and requirements.]

1) RICHMOND MICRO SOFTWARE. Box 94088, Richmond, B.C., V6Y 2A2 Canada. This system requires the Apple II (48K) system and additional hardware depending on the subsystems selected. Specific information can be provided upon request from the developer. Although the system was designed as an integrated package, each of the separate modules can be purchased separately and run independent of each other. Price for the total system is $550.00. Functional subsystems include:

Online Circulation. Requires the addition of a light pen ($250.00) and at least one disk drive. Charges out, charges in, and reserves materials using light pen on bar codes. System will handle 40,000 items, up to 1700 borrowers with 8 item transactions each, and performs a variety of specialized tasks such as reserve functions, variable loan periods, etc. $250.00.

Acquisitions. After receiving basic order information from typist, system allows user to produce multiple documents used in the acquisitions process and then passes information to card catalog program (if purchased) for production of catalog cards and spine labels. $75.00.

Catalog Card and Spine Label Production. Receives information from acquisitions program and produces complete catalog card sets and spine labels. $75.00.

Cataloging System. Designed to capture information about materials already in collection and store in machine readable form for future use. $75.00.

Magazine Accessioning System. Controls the receipt of magazines, prints out holdings lists, issues missing issue notice, etc. Up to 200 titles per diskette. $75.00.

2) RINGGOLD MANAGEMENT SYSTEMS, INC. Box 368, Beaverton, OR 97075. This system is designed to offer the library wide flexibility in the selection of hardware. Minimum hardware configuration is a (1) 4 mhz Z-80A processor/CRT workstation, (2) 64K RAM memory, (3) 10MB hard disk, (4) bar code reader, and (5) printer. Specific hardware quotations will depend on the number of workstations the library needs and the size of the library bibliographic and patron files. Price available upon request.

Online Circulation. Performs a comprehensive list of basic circulation transactions, including charge out, discharge, online query, reserves, fine payment, and a variety of reports and notices.

Acquisitions. Features all of the traditional acquisitions functions, including order preparation, automatic claiming and cancellations, duplicate order checking, and several fund accounting options.

Online Circulation/Overdue Control Systems

The following represent those systems which perform online circulation and/or overdue control as a single program function.

1) RICHMOND MICRO SOFTWARE. [See 'Integrated Systems' description.]

2) J.L. HAMMETT COMPANY, INC. Hammett Place, Box 545, Braintree, MA 02184. 'Bookworm'. Online circulation and overdue control system. Available for the TRS-80 Models I or III (16K), CBM/PET with BASIC 1.0 (8K), or Apple II (48K) with Applesoft and 1 disk drive. $59.00.

3) THE LIBRARY SOFTWARE COMPANY, Box 23897, Pleasant Hill, CA 94523. 'The Overdue Writer'. Online circulation system for libraries with weekly circulation of 500 volumes per week. Software prints overdue notices, lists of all borrowers, and other functions related to overdue materials. Requires Apple II Plus (48K) or TRS-80 I or III, one disk drive, and an 80 column printer. $124.95.

4) CTI LIBRARY SYSTEMS DIVISION, 1455 South State Street, Orem, UT 84057. 'Apple Circ System'. Online circulation control system for the small library. Maintains files of patrons, abbreviated bibliographic information, and circulation item transactions. Requires Apple II Plus, two disk drives, communications card, langauage card, Apple Cat modem, Parallel Interface card, Printer, and Light Wand attachment. $3,000.00. [Annual maintenance agreement, $400.00].

Acquisitions Systems

The following is a list of those systems which perform aquisitions support as a single program function.

1) RICHMOND MICRO SOFTWARE. [See description under 'Integrated Systems']

2) RINGGOLD MANAGEMENT SYSTEMS. [See description under 'Integrated Systems'].

Online Microcomputer Catalog Software

The following is a list of those systems which perform as a single program online microcomputer catalog.

1) COMPUTER CAT. 3005 West 74th Ave, Westminster, CO 80030. This system provides the library with an online public inquiry catalog of library materials. The system is also able to produce printed reports of library holdings, statistics, etc. Minimum configuration Apple II or II Plus (48K), disk drive, disk controller card, Corvus Disk System (5 to 20 MB), and serial card and cable if OCLC connection is required. $1995.00.

A-V/Film Booking Systems

The following list represents those system which operate audio visual materials booking and scheduling systems as a single function program.

1) NOLAN INFORMATION MANAGEMENT SERVICES. Box 18950, Los Angeles, CA 90007. Complete booking system for collections of up to 850 films. In addition to scheduling capabilities, the system generates reports including Bookings-YTD, Films Not Available, etc. Requires Apple II with DOC 3.3. $325.00.

2) RESEARCH TECHNOLOGY INTERNATIONAL. 4700 Chase Ave., Lincolnwood, IL 60646. 'AMI' Film Booking System. Complete film scheduling and statistical analysis system. System performs complex scheduling functions, produces user slips, and management reports. Requires ADDS computer system.

Cataloging Support Systems

The following list are those systems which provide cataloging support as a single program function.

1) INFORMATICS, INC. 6011 Executive Blvd., Rockville, MD 20852. 'MINI MARC' System. MINI MARC is a complete standalone computer system which allows libraries to access over 1.2 full MARC records from the Library of Congress. MINI MARC interfaces to most automated circulation systems and has a card and label production subsystem. Requires MINI MARC custom hardware. $50,000.00.

2) RICHMOND MICRO SOFTWARE. [See description under 'Integrated Systems'].

Card Catalog Processing Support Systems

The following lists those systems which provide catalog card processing support as a single function program.

1) COMPUTER BUSINESS SYSTEMS OF MYRTLE BEACH. 1707 View Street, Myrtle Beach, OR 97458.

Allows operator to enter bibliographic information, edit card layout, and produce multiple card sets. Requires TRS-80 and printer with lower case capability. $125.00.

2) RICHMOND MICRO SOFTWARE. [See description under 'Integrated Systems'].

3) TELEMARC. 1300 East 115th Street, Burnsville, MN 55337.

Complete catalog card support system including catalog card production, spine labels, book pocket labels, etc. Requires an Apple II Plus, two disk drives, printer with pin feed capability.

4) EDUCATIONAL COMPUTER PROGRAMS ASSOCIATES. 919 West Canadian Street, Vinta, OK 74301.

Complete catalog card production program. System also prints book lists, produces shelf lists by call number, and produces miscellaneous reports. Requires TRS-80 III (48K), 2 disk drives, and printer with tractor feed capability.

Serials Control Systems

The following lists those systems which provide serials control as a single program function.

1) CALIFORNIA LIBRARY AUTHORITY FOR SYSTEMS AND SERVICES (CLASS). 1415 Koll Circle, Suite 101, San Jose, CA 95112.
'Checkmate' is a serials control system designed to meet the needs of the small library collection. Functions include checkin, claiming, fund accounting, and generation of a variety of reports. Requires TRS-80 II equipment.

2) META MICRO LIBRARY SYSTEMS, INC. 1818 San Pedro, San Antonio, TX 78212.
This serial control system is a comprehensive system designed to meet the needs of all size libraries. Functions include cataloging, serial checkin, routing, claims, bindery control, financial accounting, ordering, etc. Requires the Southwest Computer Products hardware system. Price quotations available upon request.

Computer-Assisted Indexing Systems

The following is a list of those systems which provide computer aided indexing software as a single function program.

1) THE SOFTWARE EXCHANGE. 6 South Street, Box 68, Milford, NH 03055.
'Periodical Cross Reference Program'. This program allows the library to index journal articles and produce an index by subject, author, title, publication date, etc. Requires TRS-80 hardware. $19.95.

2) RICHMOND MICRO SOFTWARE. [See description under 'Integrated Systems'].

3) ROTHINES ASSOCIATES. 28 Station Plaza, Great Neck, NY 11021.
'Bookdex'. General indexing program for use with books, reports, etc. $250.00.
'Newsdex'. Newspaper indexing program. $250.00.

Both programs require hardware which is CP/M compatible, Microsoft Basic, a word processing software, and sort utility software.

Computer Aided Library Instruction Systems

The following is a list of those systems which offer computer aided instruction as a single function program function.

1) CALICO (COMPUTER ASSISTED LIBRARY INSTRUCTION COMPANY, INC.). Box 15916, St. Louis, MO 63114.
Several programmed instruction modules, including,
(1) 'Use of Periodical Indexes',
(2) 'Use of Almanacs',
(3) 'Use of Barlett's Familiar Quotations',
(4) 'Use of Current Biography',
(5) 'Use of Poetry Indexes'.
Requires Apple II (48), Applesoft, 1 disk drive, and DOS 3.3. Each software program is $25.00, entire set of 5 programs $100.00.

2) MASKOWITZ. 117 Canton Ave., Milton, MA 02186.
'Library Orientation Program'. Program performs a pre- and post- test of library users to determine success of training programs. Testing performed at three levels; Basic, Intermediate, and Honors. Requires Apple II.

3) MICRO POWER AND LIGHT COMPANY. 1108 Ketstone Park, 13773 North Central Expressway, Dallas, TX 75243.
'Library Skills Program'. Computer aided instructional program which introduces users to the library. Intended for grades 5+ Requires Apple II. $24.95.

Library Resource Sharing/Inter-Library Loan Systems

The following is a list of thoses systems offering interlibrary loan services as a single program function.

1) INFORMATION INTELLIGENCE, INC. Box 31098, Phoenix, AR 85046.
This is a turnkey software system for resource sharing and interlibrary communications between libraries and information centers. The system provides automatic calling, ILL workforms, message numbering, and unattended operation. Require Apple II Plus and special communications hardware. $2500.00.

SOFTWARE: DEVELOPMENT, REQUIREMENTS, MAINTENANCE

Most computer software used in the library environment, whether circulation system or video game, is purchased from a computer manufacturer, local computer distributor, or independent software developer. While new 'user friendly' programming languages and operating systems are continually being improved and enhanced, most libraries will continue to depend upon software development firms for most software used in the library setting.

With this in mind, it is important that the library manager realize that there is no 'standard software' on the market today. In fact, there are very few standards in the microcomputer industry, both hardware and software. For this reason, there are many factors and precautions that the library must take when selecting software for a particular microcomputer. This section attempts to build a basic understanding of factors that should influence the selection of software from a functional vantage point. It is important to understand the software evolutionary process, workspace requirements, software maintenance, and the role of reiable documentation.

Software Evolutionary Process

Level 1: In-House Development. Virtually all packaged software sold on the national level was originally developed to solve a specific problem for a specific person or institution. VisiCalc, for example, was originally developed when Dan Bricklin, an M.B.A. student at Harvard, wanted to find a faster and more efficient way to complete his case study homework problems, most of which contained long numeric calculations. Popularity of Bricklin's programs among Harvard students grew and with design assistance and financial backing from a software development house, VisiCalc is currently the most popular software package in the microcomputer market. [This is a trend which may be changing. As the profit potential for microcomputer software continues to grow, software firms are beginning to look at software development for the mass market as a potentially untapped and rich marketplace.]

Level 2: Software Initial Release. Before the software can be released to the general market, the programs must be generalized for a larger user pool, thoroughly tested, debugged, and extensive systems and user documentation prepared. After these steps are completed and marketing strategies are defined, the software is 'released' to the market. The term 'release' has taken a special and new meaning in the computer industry, indicating the version of a particular software package. Most software producers indicate the version of the software by assigning a number with the release notation. For example, when software is first introduced to the market, it is usually distrubted as 'Release 1.0'.

LEVEL 3: User Feedback. After the program is in distribution, users who have purchased the program usually send feedback to the software developers about the product. This feedback usually takes three forms:

1. Program Errors. While most reputable software developers expend large effort and financial resources in program testing, some errors can slip through which are ultimately detected by the software users. If these errors are not resolved quickly, software distrubutors will stop stocking the software and the developers have ruined their reputation in the marketplace, a marketplace with a very high percentage of repeat sales. (It is estimated that microcomputer owners spend more money on software

packages than they did on the original hardware.)

2. Inadequate Documentation. In many cases, problems with the use of the software is a result of misleading or incorrect documentation. Users frequently figure out the problems and send recommended documentation changes to the software developers.

3. Requested Enhancements. The most positive feedback which developers receive, and hope for, are requested enhancements to the software. This usually indicates a consumer market which is generally pleased with the product and would like to have more power and software processing abilities.

LEVEL 4: Patches. Immediate attention must be given to software bugs discovered by users. Program analysts get the user comments, simulate the situations under which the bugs occured, correct the source code of the program, and test the revised version for new bugs. After the tests are successfully completed, the developers distribute to each identifiable user the code which was developed to correct the bugs. This new program code is called a 'program patch'. Most patches degrade the speed at which the software performs, since the patch is an added fix of the system and not a part of the overall system design.

LEVEL 5: New Release. After some period of time, developers may have found it necessary to issue a number of patches to correct software problems. In addition, many users may have requested enhancements and/or additions to the software. When a number of both of these have been received, developers may decide to issue a new release of the software. The entire program code will be altered to incorporate all previously issued patches and, usually, several new additions to the software will be made. The product will then be re-released to the general market, and will probably carry a new release number. Software originally introduced to the market as 'Release 1.0' will probably be distributed in the revised version as 'Release 2.0'. Most software developers will allow current owners of 'Release 1.0' to swap out their software for the new release at a cost significantly less than the 'Release 2.0' sales price. By paying a small fee to receive the new version of the software, the user executes an 'upgrade' of that software package. Once the user has upgraded the software, the process continues again with Level 3.

Software Workspace and Hardware Requirements

Each software package, whether purchased from a distributor or developed inhouse, has certain minimum workspace and hardware requirements necessary to operate. These minimum requirements should be carefully evaluated during software procurement.

Internal Memory Workspace Requirements: Each program needs a minimum amount of internal memory space in which to carry out its specific instructions. The amount of internal memory necessary varies widely, from as little as 4K to as much as 256K. Prepackaged programs should always indicate the minimum required memory space needed to operate. A library should never purchase software which does not provide this information. For example, a BASIC interpreter may indicate that it requires 16K internal memory. The library has a microcomputer with 4K and 8K RAM memory, the BASIC interpreter will probably not load into the machine; and if it were able to

load, it would not have sufficient workspace to perform all of its instructions. When examining memory requirements, it is important to remember that they are expressed as minimums. A 16K BASIC interpreter should run in a 16K, 32K, or 64K memory microcomputer without difficulty.

Disk Memory Workspace Requirements. Many utility, and some applications, software programs require available disk storage workspace for the program to operate successfully. For example, many sort utilities require available space on the diskette equal in size to the file that is to be sorted. This means that the diskette can be only 50% full at the time the sort program is engaged. In this example, if the diskette was 75% full of information to be sorted, the sort utility could not be successfully run. By not allowing adequate disk workspace, the sort utility would either fill the available 25% and immediately discontinue processing or overlay the original file of unsorted information, permanently erasing any portion overlayed. Some programs require that a specific disk drive be used.

Equipment Requirements. While it may seem obvious to most users, many people purchase software which requires the use of equipment that they do not own. It is important that the library always evaluate the minimum hardware requirements for a particular software product. For example, a mailing list program probably requires the use of a printer. The program may further require that the printer be equiped with a continuous paper feed attachment for the printer.

Software Compatibility and Release Requirements

Applications software cannot be loaded into the microcomputer and executed without the use of a system control program, the operating system. It is critical that software be selected which is compatible with the existing operating system and system utilities. While it is possible to own and operate more than one type of operating system on a particular microcomputer installation, this is highly discouraged.

Software Compatibility Standards. Virtually all software is grouped by distributors and wholesalers by the type of operating system required. For example, if Accounting Pack II is designed for use with CP/M, it will not operate on a microcomputer installation which has only the UNIX operating system. Because there are a number of different operating systems in wide distribution, many software developers market the same software package for a number of different operating system environments. If this is the case, make sure that the specific package acquired by the library is designated for the operating system run at that installation. While Accounting Pack II may be available in both CP/M and UNIX versions, if the library receives the incorrect version of the software it will not perform properly.

Release Requirements. As described earlier, most major software packages have a release identifier. This identifier should play an important part in the selection of the software package. The library must make sure that the level, or grade, of the release on the software being examined is compatible with that of the operating systems and any other system utilities which must run in unison with the new software. For example, if the library owns CP/M Release 1.8 and the proposed software acquisition requires CP/M Release 2.0, the new software will not run. If the reverse were true, however, and the proposed software required CP/M Release 1.8 and the

library operated in a CP/M Release 2.0 environment, there would be no problem in acquiring the new software. As new releases of software are made available, each new release is upward compatible from the older version. A new release never eliminates capabilities of a previous version, but enhance and expands capabilities.

Software Maintenance

Software maintenance includes the correction of program code to eliminate a problem; modification of program code to allow the program to perform some special function; care and storage of program diskettes and written documentation; and, upgrading the software code to a new release level. It is strongly recommended that software maintenance be performed immediately upon discovering a problem and that a log of all maintenance performed be maintained which can provide an audit trail of actions taken.

Software Patches. There are currently two methods widely used to perform software patches. First, and most popular, is to notify the user of the needed changes and, for a moderate fee, the old diskette is exchanged with the software developer for the newer revised version of the software. This is certainly the method that the library should elect, if given a choice. The second procedure requires much more from the user. The software developer notifies the user of the patch, sends updating instructions, security codes, and the new program source code which should eliminate the problems. It is then up to the user to actually perform the update to the software. This type of patch is usually provided at no additional charge. If the later procedure is to be used, it is very important that the library completely test the program after the patch has been applied. A typographical error or code misplacement on the part of the updating library operator will probably result in new bugs which are more difficult to locate and correct. If the software developer offers a software maintenance contract, always recommended for the library, be sure to specify the procedure to be used in applying patches and new releases.

Independent Software Modification. Software modification is the altering of program code to either expand the functional capabilities of the software or to permit the software to perform the same capabilities more efficiently. For example, some microcomputer enthusiasts modify programs to make them run faster and more efficiently. Except in extreme cases, such as having a highly experienced librarian programmer on staff, the library is urged not to attempt independent program modifications. The following precautions should be considered before authorizing inhouse software modification:

1) Unauthorized changes usually invalidate the software maintenance agreement, even if it is determined that the changes made were not linked with the bugs discovered.

2) Changes in the source code may prevent the software from being upgradable. The new releases from the distributor may not be compatible with the custom program code developed at the library.

3) Changes in the source code may trigger hidden bugs in the program unrelated to the changes made. Once this occurs, correction is very difficult, even for the more experienced programmers.

4) Changes in the program will most certainly invalidate the written program documentation and user manuals. Should modifications be made, carefully update the documentation and continue to update new versions of the manuals as they are received from the software developer.

Maintenance of Program and Data Diskettes. Whenever a program or data diskette is purchased or created, it should be immediately labeled with contents description, location of user/systems documentation, and date. The label should clearly indicate if the diskette is a copy or an original, and if more than one copy is made, each should carry a unique copy number. When diskettes are erased, remove all labels to eliminate any confusion.

Maintenance of Documentation. Documentation always seems to be missing when it is critically needed. Maintenance of written documentation is usually the last project priority, a problem which permeates the entire data processing industry. Each library should designate a person responsibile for documentation and allow that individual adequate time to maintain it properly. A lack of reliable documentation will result in frustrated staff and patrons who will view the microcomputer as overly complicated, the staff as incompetent, and the project as unsuccessful.

Diskette Backup Files. Every diskette which contains an important program or data file should be copied, the copy acting as a backup file. Very few microcomputer or word processing user institutions take this precaution. In some cases, the loss of a program reflects the loss of the many hours it will take an operator to re-key the information. Under other circumstances, the information cannot be retrieved, no source documents can be obtained to rebuild the lost information. Both of these situations can be avoided with 100% assurance by copying important diskettes each time they are modified and storing the copies in a different physical location.

SOURCES OF INFORMATION ON MICROCOMPUTER HARDWARE AND SOFTWARE MARKET

MICROCOMPUTER LITERATURE

The following section presents information about the printed materials that a library may find valuable to library staff and patrons concerning the establishment and operation of a microcomputer environment in the library.

Microcomputer Periodicals and Journals. There are currently in excess of 75 periodicals and journals dedicated exclusively to the subject of microcomputers. Some of these are intended for the mass market, while others discuss microcomputers within the framework of a particular subject area or profession. A complete periodical listing can be found in Attachment 8. For those libraries who have a very limited serials budget for this type of material, it is recommended that the following three periodicals form a 'core' or beginning collection. These are:

1) INFOWORLD: NEWS FOR MICROCOMPUTER USERS. $25.00/Yr. Weekly.

2) BYTE. $19.00/Yr. Monthly.

3) CREATIVE COMPUTING. $20.00/Yr. Monthly.

Library Specific Microcomputer Periodicals. The following two publications are specifically intended for librarians and present valuable information about microcomputers in the library. These will be particularly helpful to thos libraries who plan to use microcomputers for the automation of library procedures, such as circulation, etc.

1) ACCESS: MICROCOMPUTERS IN LIBRARIES. $11.00/Yr. Quarterly.

2) SMALL COMPUTERS IN LIBRARIES. $20.00/Yr. Monthly.

Microcomputer Literature Indexing Services. A traditional problem with acquiring much of the microcomputer literature was the lack of proper indexing of the materials. Some of the more reputable publications, such as BTYE, provided periodic indexes of materials within the respective magazines. Two quality indexing services have recently been introduced to the market. These are:

1) MICRO...PUBLICATIONS IN REVIEW. $56.00/Yr. Monthly.
Vogeler Publishing Company
455 Crossen Ave.
Elk Grove Village, IL 60007

[Produces copies of title pages and subject index each month from the 61 covered microcomputer periodicals & journals.]

2) MICROCOMPUTER INDEX. $30.00/Yr. Quarterly.
2464 El Camino Real
Suite 247
Santa Clara, CA 95051

[Produces subject index to 20 microcomputer periodicals.]

General Computer Indexing Service [some microcomputer references]. The following indexes are primarily designed to provide access information about the non-microcomputer literature. There are certain materials, however, which do surface in reference to microcomputers. It is not recommended that these indexes be acquired to provide access to microcomputer literature, but if the library already owns or has access to these publications, they may provide limited information.

1) COMPUTER SCIENCE RESOURCES: A GUIDE TO PROFESSIONAL LITERATURE.
Knowledge Industry Publications
701 Westchester Ave.
White Plains, NY 10604

2) COMPUTER LITERATURE INDEX.
Applied Computer Research
P.O. Box 9280
Phoenix, AR 85068

Microcomputer Software Directories. The following publications are specifically intended to provide information about the availability of microcomputer software. Unfortunately, very little of the library processes software, such as circulation, as been picked up by these directories. They are particularly helpful, however, in identifying games, educational programs, business oriented software systems, and computer languages/utilities.

1) DATAPRO DIRECTORY OF MICROCOMPUTER SOFTWARE. (2 Volumes)
DataPro, Inc.
1805 Underwood Blvd.
Delran, NJ 08075

2) SCHOOL MICROWARE: A DIRECTORY OF EDUCATIONAL SOFTWARE.
Dresden Associates, Inc.
P.O. Box 246
Dresden, ME 04342

3) EDUCATIONAL SOFTARE DIRECTORY. (Apple software only)
Sterling Swift Publishing Company
P.O. Box 188
Manchaca, TX 78652

4) MICRO MEDIA CATALOG.
K-12 MicroMedia, Inc.
P.O. Box 17
Valley Cottage, NY 10989

5) DIRECTORY OF MICROCOMPUTER APPLICATIONS IN EDUCATION.
Gutman Library
Harvard Graduate School of Education
Appian Way
Cambridge, MA 02138

General Computer Software Directories [some microcomputer software references].

1) LIBRARY AND INFORMATION SCIENCE: A DIRECTORY OF COMPUTER APPLICATIONS.
NTIS
5285 Port Royal Road
Springfield, VA 22161

2) MINICOMPUTER SOFTWARE QUARTERLY.
International Management Services, Inc.
70 Boston Post Road
Route 20
Wayland, MA 01778

3) ICP DIRECTORY [6 Volumes]
International Computer Programs, Inc.
9000 Keystone Crossing
Indianapolis, IN 46240

4) DATAPRO DIRECTORY OF SOFTWARE
DataPro, Inc.
1805 Underwood Blvd.
Delran, NJ 08075

5) COMPUTER SOFTWARE [2 Volumes]
Alltech Publishing Comapny
212 Cooper Center
North Park Drive
Pennsauken, NJ 08109

6) APPLICATIONS SOFTWARE REPORTS
Auerbach Publishers, Inc.
6560 North Park Drive
Pennsauken, NJ 08109

7) DATA SOURCES
Ziff-Davis Publishers
One Park Ave.
New York, NY 10016

TECHNICAL REPORT SERVICES: MICROCOMPUTER HARDWARE/SOFTWARE

One of the most valuable resources available to the library manager are technical reports produced by independent computer evaluation firms. These firms

employ computer hardware and software specialists who publish reports which present evaluations and user ratings of computer hardware and software. Most of these services are updated on a monthly basis can provide very current information, including vendor pricing data.

Firms producing technical reports on microcomputer hardware and software are:

1) Datapro, Inc.
1805 Underwood Blvd.
Delran, NJ 08075

2) Auerbach Publishers, Inc.
6560 North Park Drive
Pennsauken, NJ 08109

3) Benchmark Reports
Association of Computer Users, Inc.
Research and Education Division
P.O. Box 9003
Boulder, CO 80301

Each of the reports produced by these companies vary in content and scope. They all, however, provide information on most of the areas described below.

1) Company History. Brief information about the company history, policies, and officers. If the company is owned by a conglomerate, this information is usually provided.

2) Product Marketing. Provides count of dealers which represent product, numbers of installations currently sold, and date product was first introduced to the market.

3) Hardware Descriptions. Provides the reader with an inventory of all central features of the equipment, including, memory components, all attachable peripheral devices, and information about expansion options and limitations.

4) Data Communications. If the device is capable of communications, information is provided about the necessary hardware and software expansions, protocols required, and interface capabilities with other types of communications equipment.

5) Software. Detailed information about operating system(s), programming languages, utilities, data base management systems, communications software, and any available applications software.

6) Support Services. Lists the available support services provided by the manufacturer, including, documentation, training, terms/conditions of sale, and warranty information.

7) Costs. Pricing information for purchase, lease/purchase, and maintenance are usually provided.

8) User Ratings. When a product has been on the market for at least one full year, the reports usually list numeric user ratings in areas such as overall satisfaction, ease of use, dependability, maintenance, documentation, etc.

Any library investigating the purchase of computer services, microcomputer or otherwise, should consult independent technical reports such as those described herein.

USER GROUPS

User groups are computer enthusiasts who usually share the common goal of sharing information which will enhance the use of certain types of computers or software. There are several possible characteristics that a user group can focus on, including:

1) Specific brand of microcomputer
2) Geographic area (local or regional clubs)
3) Programming language
4) Professional interest (medical, law, etc,)
5) Hobbies
6) Application software package (VisiCalc, etc.)

The primary reason that user groups continue to grow and expand are (1) to exchange software between members of the group, (2) provide guidance in the selection and procurement of computer hardware and software, and (3) continuing education. The library should seek out any groups which might exist in the local area. It is quite possible that leaders of these groups can assist the library in procurement of equipment, development of a software library, education of staff and patrons, and establishment of policies for the microcomputer center.

User groups do have one specific problem area; software piracy. Commercial developers are very concerned about the practice by many user groups of purchasing one copy of a software package and making it available to club members for duplication. This is, of course, a concern many distributors and developers of software will have about procurement by a library. It is very important that the library protect the claim that developers have to software copyright. Piracy of software is the responsibility of library management personnel.

For additional information about user groups, please consult Appendix 6.

VENDORS

Vendors are a very important source of information about computer hardware and software. Unfortunately, the vast majority of institutional and individual consumers depend on vendors for all the information on which a decision is based. IT IS CRITICAL FOR THE LIBRARY TO BALANCE THE INFORMATION PROVIDED FROM VENDORS WITH THAT OF MORE OBJECTIVE SOURCES. It is the goal of the vendor to sell the computer product whether the product is, or is not, best suited for a particular library environment.

The vendor is not in a position to determine the best needs of the library; this is the sole responsibility of the library manager.

Microcomputer Vendors.

Microcomputer hardware and software is now marketed in a number of different ways. These include:

Computer Stores. Computer stores are well established as the sales medium for the individual or hobby computer buyer. These stores are sometimes part of a large chain, such as ComputerLand and ComputerWorld, or are independently owned and operated. Most computer stores carry several brands of microcomputer hardware and software, provide training, maintanence, and computer related supplies.

General Merchandising Stores. Many of the large national general merchandise stores, such as Sears, are beginning to market microcomputers. The equipment and software being heavily marketed by these firms, at the present time, concentrates on the video games portion of the computer market.

Computer Companies. Some microcomputer equipment is available only from the local manufacturer marketing offices. These are systems primarily designed for the business market. Most of the sales placed by this type of marketing effort result from visits to the local business by regional sales personnel and the buyer may never actually go to the marketing office.

Office Equipment Dealers. Many established dealers of office supplies and equipment are beginning to stock microcomputer hardware and software. As with the computer store, several brands of equipment may be marketed. To date, most marketing efforts by this group are concentrated on the small business requiring word processing, accounting, etc.

Mail Order. Mail order is continuing to grow in the total share of microcomputer sales. Both hardware and software products are marketed using both direct mail and magazine advertising. As with any other mail order purchase, great care should be taken to investigate the reputation of the distributor before purchasing through the mail. Some software packages are sold only through the mail.

PROCUREMENT OF HARDWARE AND SOFTWARE

Procurement of computer hardware and software is the point during the entire automation process where most library managers feel the most anxiety and where most of the significant mistakes are made. This section attempts to briefly present the recommended steps that every library should perform during the procurement of microcomputer hardware and software.

Developing the Systems Plan. Before any vendors are contacted, any advertising designed, any furniture purchased, or any staff reassigned, the library procurement team should develop a 'systems plan'. This plan should include, but is certainly not limited to:

1) Define Installation Users. Determine exactly what users the equipment is intended to serve. This might include children, adults, business professionals, college students, library staff, etc.

2) Group Access Plan. Depending on the groups assigned, broadly estimate (probably on a weekly schedule breakdown) the number of hours each group is to have access to the microcomputer. Great care should be taken in designing these estimates. At this point, many differing assumptions by procurement group members will probably surface. Make time estimates as realistic as possible. This information will become valuable in determining how many machines will be necessary, the complexity levels of the machines, and how some groups may have restricted access times after machine access hours are assigned.

3) Group Tasks. For each group identified, prepare an inventory of the tasks it is anticipated each group will perform on the microcomputer equipment. For example, children will need video games and educational software, library staff will need indexing software, etc.

4) Software Inventory. Investigate the availability of the software functions desired by reading the microcomputer literature, contacting user groups, vendors, etc. Attempt to attach certain software products to each of the desired group tasks identified. There will probably be certain tasks for which no suitable software can be located. In this case, the tasks must be redefined or eliminated and corresponding changes made to group access times which were assigned in step 3.

5) Software Minimum Requirements Inventory. For each of the prefered software packages identified, prepare an inventory of the **minimum** hardware and software resources required. For example, a particular word processing package might require (a) CP/M operating system, (b) 64K RAM memory, (c) two 5 1/4 inch disk drives, and (d) 80 column printer.

Develop a Configuration Plan. Once software inventory and minimum requirements have been established and user access times assigned, prepare in minimum configuration plan which will be used to interview vendors. [It may be determined that more than one machine is required. Prepare a configuration plan for each different type of machine required.]This plan should be organized as follows:

1) Maximum Memory. The plan should require internal memory resources sufficient to meet the needs of the software package with the largest memory requirements.

Vitually all software packages can run in a memory size larger than they require, but certainly not smaller.

2) Operating System. The plan should designate a primary operating system. If certain software packages require an alternative operating system, software selections must be modified or additional hardware must be purchased. It may be determined at this point that two different types of machines must be acquired specifically for this reason.

3) External Storage Requirements. The plan must include external storage requirements to provide for the software package and/or application with the largest storage needs. This is particularly true if library procedures such as circulation or acquisitions are to be performed.

4) Peripheral Devices. List all types of peripheral devices required. Where a peripheral device has certain options, specify the options required.

Vendor Interviews. Identify and interview the vendors which market products suitable according to the configuration plan. Do not allow the procurement committee to deviate too far from the plan. Vendors, by design, can be very persuasive. Prepare an inventory of hardware and software characteristics for each vendor product examined. Ask the vendor for individual or business references who can be contacted about the specific products examined. Do not purchase equipment for which user references are not provided.

User Interviews. Contact several users and arrange times to visit and discuss products. These interviews should be carefully designed and include the following information.

1) Exact equipment and software owned by the user site.

2) Inventory of all hardware expansion options owned by user site.

3) Current staffing levels of automation project; identification of levels of difficulty for all software operated.

4) Overall satisfaction with equipment and software.

5) Demonstration of input/output of software programs. [Look for ease of operation and number of steps required.]

6) Examine examples of all reports generated.

7) Look for response times during demonstration; ask user site for estimates of best/worst response times since purchase. If wide variance exists, what is explanation in opinion of user site.

8) Review any historical losses of data and how recovery was completed. For example, number of diskettes that have been destroyed, data lost when CRT screen locks, etc.

9) Examine history of vendor relationshiop with user site. [Will probably be good; vendors rarely give out names of unhappy users.]

10) Seek identity of other users in the local area which can be contacted.

11) Review documentation with user; determine problems and weaknesses.

12) Ask user for list of all improvements, hardware and software, which user would recommend.

Technical Reports/Literature Review. Narrow the field of possible products. Carefully search the literature and technical reporting services for additional information about each potential product. Should problems or questions surface, ask vendor for explanation.

Product Selection. Based upon the research, interviews, and costing variables, rank the top three products under consideration.

Negotiate Contract. [At this point, some libraries will find it necessary to prepare bid specifications. Should public competitive bidding be required by the library, the traditional procurement regulations take over from this point forward.] Barter with each of the top product vendors. Allow each to make the best cost, supplies, and training offer. Based upon these offers, award a contract to the appropriate vendor.

Establishing the Contract. In addition to the traditional library contracting procedures, verify that the library is protected as follows.

1) Define each equipment component purchased and the delivery date.

2) Define each software package, including release number, and delivery date.

3) Specify the right for the library to produce multiple copies of all purchased documentation.

4) Define right to upgrade to all new hardware and software releases.

5) Define absolute minimum response time requirements. This is difficult to define, however, under no circumstances shall the response time on an applications program be in excess of 5 minutes, on a utility sort in excess of 1 hour.

6) Define right to modify software.

7) Define specific training/education provisions negotiated.

8) Retain the right to modify software.

9) Define maintenance agreements and specify renewable option.

MANAGEMENT OF THE PUBLIC ACCESS MICROCOMPUTER PROGRAM

The introduction of the public access microcomputer to the library environment presents new challenges, opportunities, and problems to library managers and supervisors. Most libraries that have entered into a public access microcomputer program have, to date, found public reaction to be positive, pulled in new library users, and received a great deal of publicity. Managers have also experienced problems with increased noise, new demands on already burdened public service staff members, and demands for expensive software and hardware enhancements. In establishing the microcomputer program, it is important that the program be carefully defined, well planned, properly budgeted, and implemented only after all components of the program are fully in place and in an operational mode.

Location of the Microcomputer Site in the Library

Location of the microcomputer site plays a very important part in the success of the program. In examining the various location alternatives, keep in mind the following factors:

Equipment Requirements. As discussed in previous sections, microcomputer hardware operates within specific environmental tolerances. Where possible, the microcomputer workstations should not be located next to large windows where the equipment would recieve direct sunlight, or where users would experience CRT glare. If more than one workstation and/or peripheral device is to be installed, site preparation should be considered from a cost standpoint. Location in an area with easy access to high grade wiring will ultimately save the library site preparation costs.

Supervision Requirements. The workstations be should be located to accomplish the dual purpose of allowing the librarian to prevent misuse of the equipment and allowing users ready access to staff should problems arise with either the software or equipment. In those libraries which have microcomputer activities, the librarian is frequently required to monitor workstation scheduling and prevent patrons from circumventing the signup procedure.

Noise. Noise continues to be the major complaint against use of the microcomputer in the library environment. This is particularly true where children and adolesents use video games at the workstations, accompanied by screams of success or failure. Some libraries have located the equipment in isolated areas or rooms of the library to prevent distracting other patrons, and other patrons bothering the serious programmer. The primary criticism of isolated areas is a lack of easy direct supervision.

Physical Security. One of the precautions which must be exercised in monitoring the use of the microcomputer installation is theft and vandalism. Some libraries and schools who operator microcomputer centers have experienced the theft of microprocessor boards from the inside of the computer and printer components. Theft of microprocessor boards can cost the library thousands of dollars to replace and render the workstation totally inoperable until repairs have been completed. Some programs have also experienced the theft of smaller items such as printer daisy wheel elements, printer ribbons, disk cables. While these are not costly to replace, their absence can cause nagging delays for other serious and more honest library users.

Microcomputer Workstation Scheduling

It is a commonly accepted practice to establish policies concerning advance scheduling of each microcomputer workstation. User needs may be difficult to determine during the early stages of the project, but most users prefer the structure and dependability of advance signup policies which provide all potential users with reasonable access to the equipment. While practices do vary from library to library, the following guidelines are used by many libraries in the scheduling of equipment.

Age Restrictions. It is recommended that children 6 years and younger not be permitted to have access to the equipment without supervision of an adult. This is to protect the child, library, and prevent disturbing other users in the microcomputer clinic area.

Advance Sign-up Sheets. Once peak demand times have been identified, most libraries have found it helpful to provide advance signup for those serious users who regularly use the equipment. This prevents wasted time on the part of patrons and prevents the library staff from constantly becoming involved in arguments between patrons about access to equipment. This policy does, however, require the library staff to monitor time allotments and supervise the smooth flow from one patron to the next.

Time Blocking Policies. Many libraries cater to a variety of very different groups as part of the goals and objectives of the project. For this reason, it is sometimes helpful to dedicate certain blocks of time, usually on certain days, for special groups of library patrons. For example, many libraries set aside several hours on each weekday late afternoon for children to play video games or work with educational software. At times later in the night, blocks of time may be reserved for adults involved in developing applications programs. Certainly, time may be dedicated during the regular work hours for library staff to gain access to equipment to perform library business or as part of a professional policy.

Use Type Categories. When establishing signup policies and procedures, it is generally wise to allow users to vary the amounts of reserved time depending on the type of tasks being performed. For example, it would be wise to allow serious program developers to sign up in one hour increments. Game players are frequently restricted to 20 or 30 minutes. It is strongly recommended that signup time allotments be uniform during any designated 'peak' type hours. Another way in which this type of category access is restricted is by machine assignment. If more than one machine is owned and operated by the library, certain machines could be designated for certain types of activites. For example, it is recommended that in a multi-microcomputer environment one or more computers be restricted from use by game players. This will prevent domination of the equipment by this extremely active group and prevent the degradation of the equipment which usually accompanies video game oriented microcomputers.

Management of Microcomputer Software and Documentation

It is not at all uncommon for the library, over a period of years, to invest as much or more money in software as was originally needed to purchase the hardware. In order to protect this investment, strict policies should be established which expli-

citly define the use and restrictions concerning access to library owned software. In addition to the obvious problems of careless damage, theft, or loss, the library does have an ethical responsibility to software developers to restrict, to the best of their ability, piracy of software. Piracy is currently the biggest threat to the continued development applications software.

Software Storage Policies. The library consider adopting all or part of the following policies.

1) Immediately upon receipt of software from the distributor or developer, the library should make a disk to disk, cassette to cassette copy of the program. The original should be permanently filed in a restricted off-site location (away from the microcomputer installation). The copy should then be labeled clearly with a warning against unauthorized copying and stored with the documentation in a reserve type, non-public access area. Only the copy should be loaned to the public and staff for use with the system.

2) All software should be restricted to library use only.

3) Except in those cases where software is used in multiples to perform some specific task (CP/M + MBASIC + WORDSTAR), only one software package should be released to a user at one time. Users should be prohibited from passing software diskettes from machine to machine. All access to library owned software should be controlled through the staff software coordinator.

Documentation Storage Policies. Like software, software documentation should be classified as library use only. If the documentation is a manual or user's guide to productional software, the doumentation should accompany the software in the microcomputer reserve area. While the copying of software diskettes is strictly prohibited by law, duplication of written documentation is protected like all other copyrighted material, and can be photocopied for personal use.

Fee Based Public Access Computer Services

Many libraries are beginning to view microcomputers as another technological contribution that the library should make available to the public for a nominal fee. As with photocopy and microfilm machines, microcomputers are also available for operation as a coin operated system. One caution should be noted in the use of coin operated microcomputers, patrons will and have a right to be more demanding of the quality of hardware and software for which they will pay on a minute by minute basis. As with photocopy machines, the library staff will be approached to intervene whenever a patron feels performance of the microcomputer has not been proper. There are currently two companies which specialize in assisting libraries establish a fee based microcomputing facility. These are:

1) MICRO TIMESHARING COMPANY. 20 Carmel Ave., Box 4658, Salinas, CA 93912. Micro Timesharing uses a somewhat unconventional approach to placing microcomputers in the library. Rather than selling the library hardware or software, Micro furnishes the library with one, or more, workstations consisting of an Apple II (48K), one disk drive, a printer, and a variety of applications and systems software. All of this is supplied at no cost to the

library with the uderstanding that Micro keeps 95% of the gross receipts from the operation of the machine. It should also be clearly understood that library administration and staff use would be on a strictly payment basis, identical with library patron use.

2) COMPUVEND COMPUTER SYSTEMS, INC. 5211 Oxford Ave., Philadelphia, PA 19124
Compuvend provides a specialized coin-operated microcomputer table for use in the library environment. The library can purchase any brand of microcomputer and once attached to the coin-operated table, the receipt of coin or paper money from the patron initiates a timer and allows the library patron a certain number of computing minutes. In order to prevent shutting off the power at an inappropriate point during the processing of a user program, the table signals the user one minute before time expires in order to allow more time to be purchased. One speacial feature offered by Compuvend is a key operated library staff override feature, allowing the staff access to the microcomputer without cost.

Other Public Access Microcomputer Library Programs

Orientation. Many libraries require that any person using the microcomputer work area must attend a library orientation. This orientation should review:

1) Inventory of all equipment intended for public use.

2) Inventory of all software intended for public use.

3) Identification of library staff available to assist public in the use of the microcomputer workareas.

4) Library policies.

5) Scheduling procudures.

6) Software piracy.

Continuing Education Programs. Many libraries have incorporated the microcomputers into the library public education program. Classes are taught by either library staff, local community college personnel, or users groups. Libraries operating these programs have offered classes on topics such as programming, use of specific applications software (VisiCalc, MailingList, etc.), how to develop computer games, word processing, etc.

Money Making Opportunities. Some libraries are beginning sell computer supplies and support materials to the public as a fund raising effort for either the library or Library Friends group. This provides income to the library and can be a great convenience to the microcomputer user. Items for sale could include diskkettes, user reference cards for software, pin feed mailing labels, etc.

APPENDICES

Appendix 1: Guide to Microprocessors

Appendix 2: Bibliography

Appendix 3: How to Interpret Hardware Product Literature

Appendix 4: How to Interpret Software Product Literature

Appendix 5: Reading a Microcomputer Hardware Configuration Schematic

Appendix 6: Computer Clubs and Microcomputer User Groups

Appendix 7: ASCII Character Set

Appendix 8: Microcomputer Literature

Appendix 1: Guide to Microprocessors

In reviewing the hardware product literature, frequent references are made to the types of microprocessors contained in the device. In order to assist the library manager in examining and differentiating among microprocessor references, the following describes each of the types of microprocessors likely to be referenced. The manager, once informed of the microprocessor types, can question the vendor of the significances of microprocessor selection in terms of machine computing performance and ability.

1) Read Only Memory (ROM). The functions that are to be performed are designed directly into the hardware. This means that no 'software' is necessary for the microprocessor to function. The primary disadvantage with this type of memory is inflexibility. If a design error is detected in the hardware programming, the microprocessor cannot be altered as could a software driven microprocessor. Used primarily for CRT character formation, CPU components, etc.

2) Programmable Read-Only Memory (PROM). This is a microprocessor which can be hardware programmed in the field, as opposed to ROM which must be programmed at time of manufacture. PROM processors are programmed by applying power surges to certain processor pins and causing it to fuse either as a '0' or '1'. PROM can only be programmed once, so if the fuses are set to accomplish a particular purpose, they cannot be altered.

3) Erasable Programmable Read-Only Memory (EPROM). These microprocessors are similar to PROM in that they are electrically programmed. The difference, and the means by which the device can be reprogrammed, is that the pins are not permanently altered when programming takes place. They are simply 'supercharged' with electrical charges which can remain active for years without additional recharging. When the function of the microprocessor is to be altered, the microprocessor is exposed to ultraviolet light and the charges 'seep' from the various holding pins and the processor can be reprogrammed.

4) Electrically Alterable Read-Only Memory (EAROM). Like the EPROM, this microprocessor can be reprogrammed. The primary difference, however, is that the device does not have to be removed from the computer, completely erased, and only then reprogrammed. This microprocessor can be altered, selectively, by applying carefully controlled voltages to important components of the processor which need to be changed to reflect the new instructions. This allows the device to be reprogrammed while it remains resident in the computer device.

5) Random Access Memory (RAM). This is a very common microprocessor, used in internal memory storage components. All actions performed on the RAM microprocessors are directed by software instructions and this device can easily be subjected to repeated reading and writing. It has a major weakness, unlike the previously described technologies, in that it will lose all data stored when electrical voltage is discontinued.

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Appendix 3: How to Interpret Hardware Product Literature

When examining microcomputer hardware product literature, look for the following categories of information. In most cases, this information is summarized in the literature under the heading of 'Specifications'. Use these various categories of information as the means to compare one product to another. The specifications presented for a particular product should be the primary focus of literature evaluation and the librarian should attempt to not be influenced by the graphics and photographic qualities of the brochures in selecting a product.

Use the 'specifications' on page 67 as an example.

Specification Categories to be Examined.

[Identified on the example]

1) Processor. Determine the exact type of processor board. The type of computer languages, compilers, and applications software can be restricted by the use of certain processor boards. Examine whether the processor you are using is an 8-, 16-, or 32- bit processor.

2) Bus Standard. It is recommended that the S-100 bus be required.

3) Disk Capacity. Determine the a) number of disks that can be attached, b) the technology of disks, and c) the capacity of each disk. Also determine if additional disk controller boards are required when the maximum disk units are attached to the machine.

4) Communications Interface. It is recommended that the RS-232-C interface be required.

5) RAM Storage. Determine the amount of user addressable memory. All applications software packages will require a minimum RAM memory in which to operate.

6) Power Requirements. Verify that a standard power source can be used. Otherwise, special physical site preparation will be required.

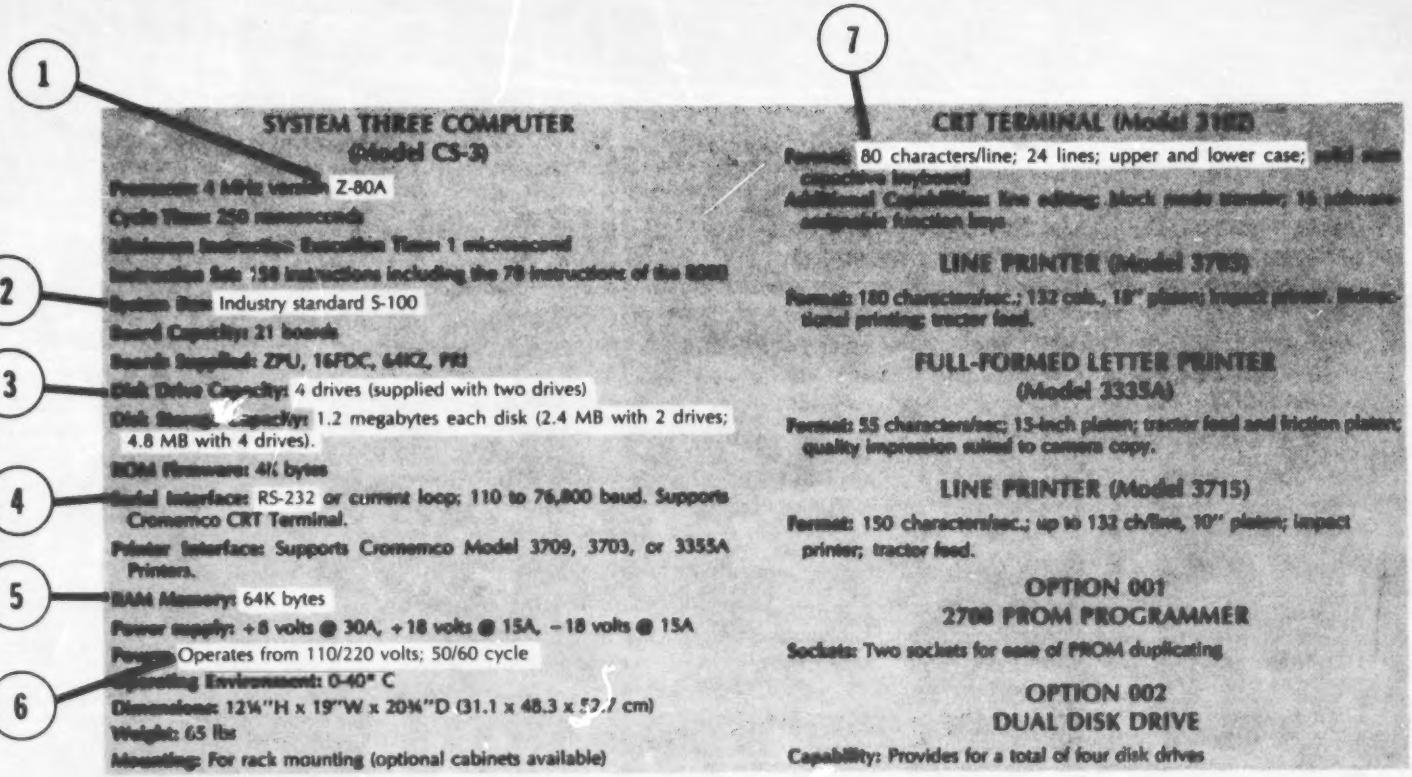
7) CRT Display Configuration. Determine the type of CRT display formats used. It is recommended that the standard 24 lines/80 characters display format be required. Use of a non-standard display format will restrict the use of much of the applications software available.

[Categories not identified on the example. List product literature omissions and obtain additional information from dealer or manufacturer. Very few product brochures are complete.]

8) Operating System. Verify the operating system software supported.

9) Expansion Board Slots. Determine the exact number of expansion board slots available and any restrictions on use.

10) Character Set Supported. Determine the character set supported. It is recommended that ASCII be required.


1
2
3
4
5
6
7
SYSTEM THREE COMPUTER
(Model CS-3)
Z-80A
Industry standard S-100
Cycle Time: 250 nanoseconds
Minimum Instruction Execution Time: 1 microsecond
Instruction Set: 158 instructions including the 78 instructions of the 8080
Board Capacity: 21 boards
Boards Supplied: ZPU, 16FDC, 64KZ, PBI
Disk Drive Capacity: 4 drives (supplied with two drives)
Disk Storage Capacity: 1.2 megabytes each disk (2.4 MB with 2 drives; 4.8 MB with 4 drives).
ROM Firmware: 4K bytes
Serial Interface: RS-232 or current loop; 110 to 76,800 baud. Supports Cromemco CRT Terminal.
Printer Interface: Supports Cromemco Model 3709, 3703, or 3355A Printers.
RAM Memory: 64K bytes
Power supply: +8 volts @ 30A, +18 volts @ 1.5A, −18 volts @ 1.5A
Power: Operates from 110/220 volts; 50/60 cycle
Operating Environment: 0-40° C
Dimensions: 12¼"H x 19"W x 20¾"D (31.1 x 48.3 x 52.7 cm)
Weight: 65 lbs
Mounting: For rack mounting (optional cabinets available)
CRT TERMINAL (Model 3102)
Format: 80 characters/line; 24 lines; upper and lower case; solid state capacitive keyboard
Additional Capabilities: line editing; block mode transfer; 16 software-assignable function keys
LINE PRINTER (Model 3703)
Format: 180 characters/sec.; 132 cols., 18" platen; impact printer. Bidirectional printing; tractor feed.
FULL-FORMED LETTER PRINTER
(Model 3355A)
Format: 55 characters/sec; 15-inch platen; tractor feed and friction platen; quality impression suited to convey copy.
LINE PRINTER (Model 3715)
Format: 150 characters/sec.; up to 132 chr/line, 10" platen; impact printer; tractor feed.
OPTION 001
2708 PROM PROGRAMMER
Sockets: Two sockets for ease of PROM duplicating
OPTION 002
DUAL DISK DRIVE
Capability: Provides for a total of four disk drives

Appendix 4: How to Interpret Software Product Literature

WORD/TEXT PROCESSING	(3)	(4)	(5)	(6)
Spellbinder.....	Lexisoft	$490	$50	2,5,9,4
Benchmark.....	Metasoft	480	--	2,6
WordStar.....	MicroPro	440	60	5,9,10
Spellguard.....	ISA	285	25	2,5,14
Spellstar.....	MicroPro	240	30	5,14
Mince.....	Unicorn	140	30	2,5,10
Scribble.....	Unicorn	140	30	3,5,10
Wordmaster.....	MicroPro	130	40	5,10
TextWriter III.....	Org Soft	120	40	2,5,14
Tex.....	Digital Res	100	50	5

SYSTEM REQUIREMENTS: All software requires a CP/M operating systems as well as indicated requirements listed below:

1 Recommended System - CP/M 1.4 or Higher. 48K Memory. 200K Dual Disks. 24 x 80 Cursor Addressable Terminal. 132 column Printer.
2 48K Memory or Higher.
3 56K Memory or Higher.
4 64K Memory or Higher.
5 CP/M 1.4 or Higher.
6 CP/M 2.0 or Higher.
7 CBASIC-2
8 BASIC-80 (MBASIC) 4.51.
9 Signed License Required Before Shipment.
10 Cursor Addressable Terminal
11 Requires No Hardware Modifications
12 Specify Z80,8080,CDOS
13 Supplied in Source Code
14 Compatible Word Text Processor
15 BASIC-80 (MBASIC) 5.0 or Higher
16 Must Specify Host Applications Langauge
17 Requires Z80 CPU
18 Price Includes Two Configurations
19 May Require UltraSort or QSORT.

1 - Software Category
2 - Software Product Name
3 - Software Developer
4 - Price/Software & Manual
5 - Price/Manual Only
6 - System Requirement Reference Numbers
7 - System Requirements References

Appendix 5: Reading a Microcomputer Hardware Configuration Schematic

Preparation of a schematic for each computer system under consideration is the best procedure to use in examining the minimum and maximum hardware resource potentials. This is a very easy procedure to accomplish and will allow a much easier basis of comparison between the various hardware products. The examples provided on pages 70 - 72 illustrate the three documents which should be produced by library staff to complete a microcomputer system schematic. The IBM Personal Computer (PC) has been used as a practical example.

Schematic One: Minimum Configuration. [example, page 70]

Prepare a diagram which identifies:

1) Each of the existing hardware resources included in a minimum configuration.

2) Each of the expansion slots available, and any restrictions or special features. For example, 'Open Card Slot #2' has a RS-232-C connector.

3) Each special requirement of the system. For example, one video display must be attached if applications software using video display commands are used.

Schematic Two: Expansion Card Options Inventory. [example, page 71]

Prepare a diagram which identifies:

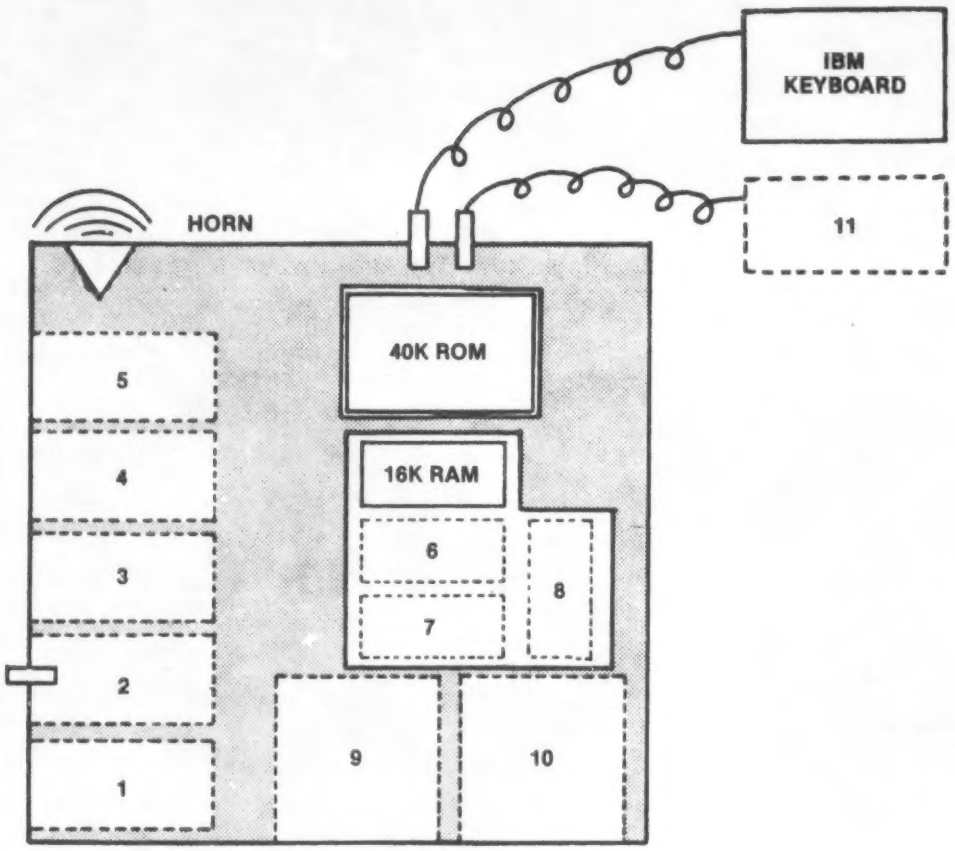
1) Each of the possible expansion cards which can be obtained for the system.

2) Each restriction on the use of the expansion cards. For example, ASCII Communications Card must reside in slot #2.

Schematic Three: Desired Configuration. [example, page 72]

Prepare a diagram which identifies the desired hardware configuration based upon the software and functional needs previously identified by the library. It is at this point that restrictions on the use of many expansion features might surface. For example, with only one card slot open, only one additional peripheral device may be added, or, an existing device or memory must be removed.

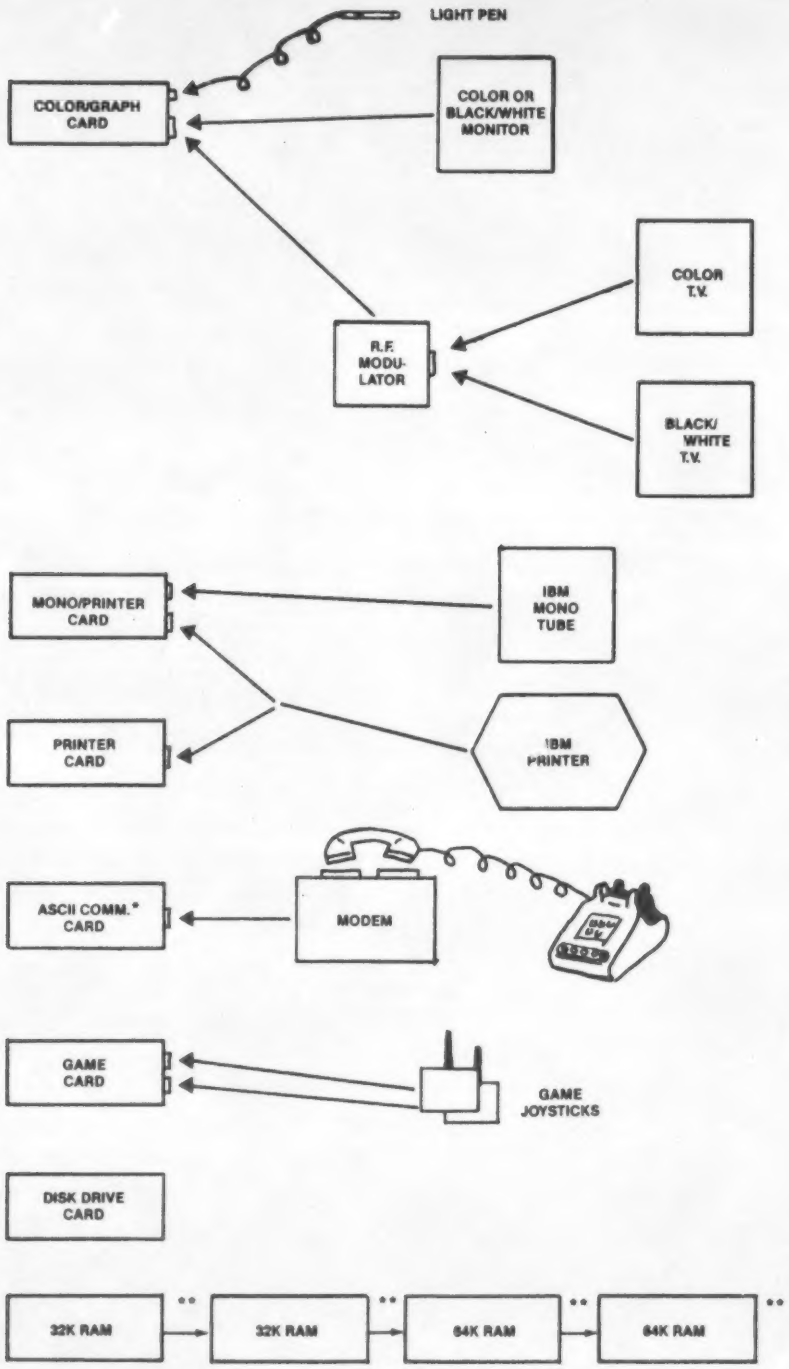
IBM PERSONAL COMPUTER (MINIMUM CONFIGURATION)



*NOTE — AT LEAST ONE VIDEO DISPLAY DEVICE MUST BE ATTACHED FOR APPLICATIONS REQUIRING VIDEO DISPLAY.

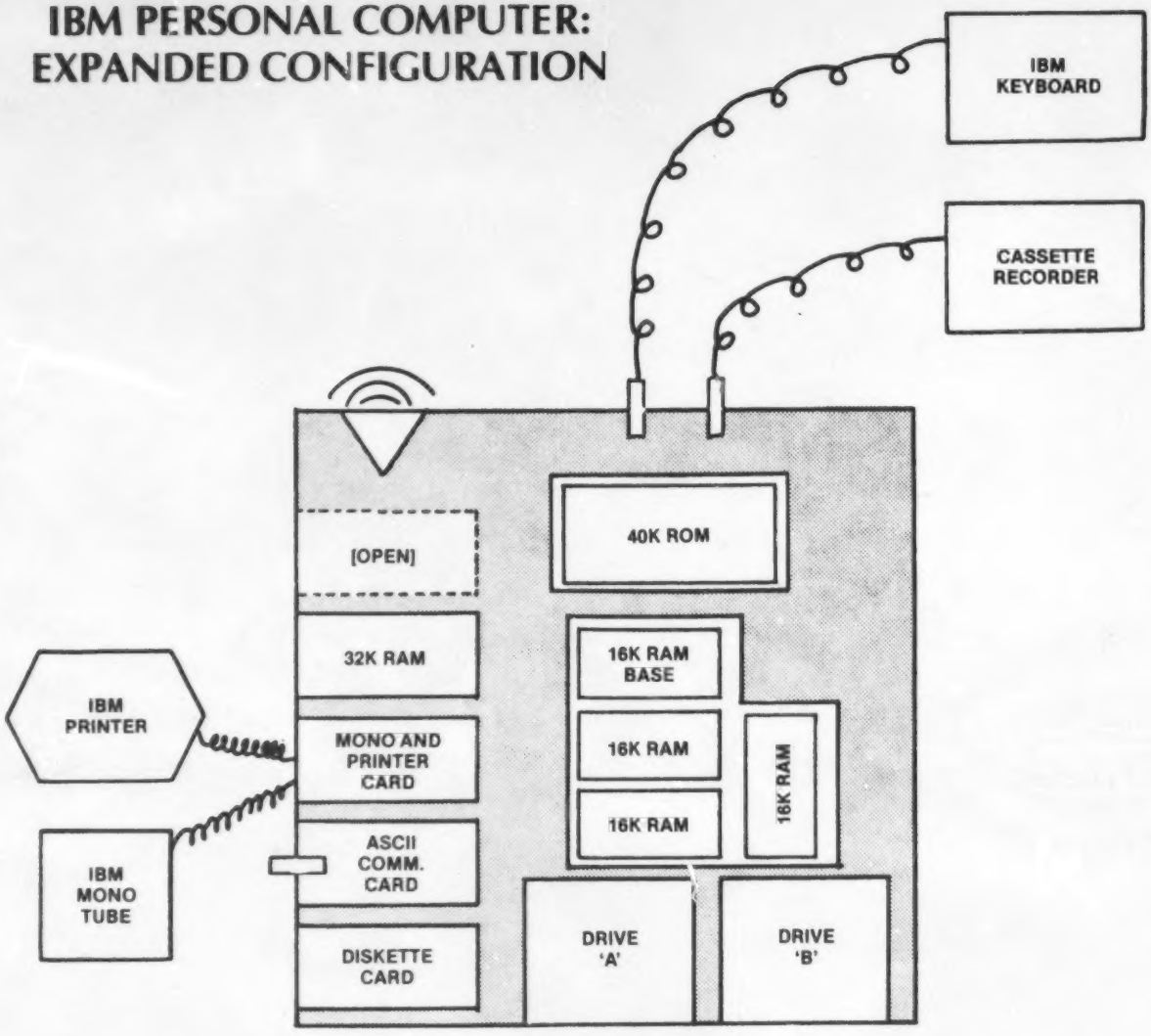
1. OPEN CARD SLOT
2. OPEN CARD SLOT, WITH RS-232C CONNECTOR
3. OPEN CARD SLOT
4. OPEN CARD SLOT
5. OPEN CARD SLOT
6. OPEN 16K RAM SLOT
7. OPEN 16K RAM SLOT
8. OPEN 16K RAM SLOT
9. OPEN DISK DRIVE SLOT A
10. OPEN DISK DRIVE SLOT B
11. CASSETTE RECORDER CONNECTOR

ADAPTER/MEMORY EXPANSION CARD OPTIONS



*MUST RESIDE IN SLOT #2.
**ADDED ONLY IN SEQUENCE; ADDED ONLY AFTER 64K of 16K INCREMENTS

IBM PERSONAL COMPUTER: EXPANDED CONFIGURATION



NEW CONFIGURATION INCLUDES:

1. MEMORY
   - 1.1 40K ROM
   - 1.2 96K RAM (16K BASE + 16K + 16K + 16K + 32K)
2. 2 DISK DRIVE (INCLUDES DISK INTERFACE CARD)
3. COMMUNICATIONS ABILITY (INCLUDES ASCII INTERFACE CARD)
4. VIDEO DISPLAY
5. PRINTER
6. CASSETTE RECORDER

Appendix 6: Computer Clubs and Microcomputer User Groups

Libraries should contact these groups to arrange for the exchange of newsletters and software. Some of the best policy and management information can be acquired from user groups and computer socities.

General Interest Computer Groups.

Boston Computer Society
Three Center Plaza
Boston, MA 02108

Arizona Computer Society
P.O. Box 15623
Phoenix, AR 85060

Atlanta Computer Society
P.O. Box 888771
Atlanta, GA 30357

San Diego Computer Society
P.O. Box 81537
San Diego, CA 92138

Association of Computer Users
4800 Riverbend Road
P.O. Box 9003
Boulder, CO 80301

North Orange County Computer Club
P.O. Box 3616
Orange, CA 92556

South Florida Computer Group
Fort Lauderdale Section
P.O. Box 698
Hollywood, FL 33022

Apple Microcomputer Based Groups.

International Apple Corps
P.O. Box 2227
Seattle, WA 98111

San Francisco Apple Core
1515 Sloat Blvd., #2
San Francisco, CA 94132

The Apple Guild
P.O. Box 371
Weymouth, MA 02188

Apple Medical Users Group International
2914 East Katella
Suite 208
Orange, CA 92667

IBM Personal Computer Based Groups.

Personna
P.O. Box 759
Point Pleasant, NJ 08742

Radio Shack Based Groups.

West Oakland Computer Users
1691 Eason
Pontiac, MI 48054

Chicago TRS-80 Users Group
203 North Wabash
Suite 2118
Chicago, IL 60601

North Miami Beach Computer Society
17400 Northeast 7th Court
North Miami Beach, FL 33162

TRS-Nibblers Club
Chabot College
25555 Hesperian Blvd.
Hayward, CA 94545

Operating System Oriented Groups.

CP/M Users Group
164 West 83rd Street
New York, NY 10024

/user/group
P.O. Box 8570
Stanford, CA 94305

OASIS Users Group
P.O. Box 2400
Santa Barbara, CA 93120

Computer Language Oriented Groups.

USCD PASCAL Users Group
P.O. Box 1148
La Jolla, CA 92038

Nevada COBOL Users Group
5536 Colbert Trail
Norcross, GA 30092

Other Miscellaneous User Groups.

International Home Computer Users Association
P.O. Box 371
Rancho Santa Fe, CA 92067

Alpha Micro Users Society
8380 S.W. 151 Street
Miami, FL 33158

Proteus
1690 Wodside Road
Suite # 219
Redwood City, CA 94061

Micropolis Users Group
604 Springwood Circle
Huntsville, AL 35803

Desktop Bay Area User Group
3200 Hillview
Palo Alto, CA 94304

OSIO
9002 Dunloggin Road
Ellicott City, MD 21043

First Osborne Group
P.O. Box 11683-A
Palo Alto, CA 94306

Intercolor-Compucolor Users Group
5250 Van Nuys Blvd.
Van Nuys, CA 91401

PET Users Group of the Silicon Valley
22355 Rancho Ventura
Cuppertino, CA 95014

Appendix 7: ASCII Character Set

Dec	Hex	Binary	Char	Dec	Hex	Binary	Char	Dec	Hex	Binary	Char	Dec	Hex	Binary	Char
000	00	00000000	NUL	032	20	00100000	sp	064	40	01000000	@	096	60	01100000	`
001	01	00000001	SHO	033	21	00100001	!	065	41	01000001	A	097	61	01100001	a
002	02	00000010	STX	034	22	00100010	"	066	42	01000010	B	098	62	01100010	b
003	03	00000011	ETX	035	23	00100011	#	067	43	01000011	C	099	63	01100011	c
004	04	00000100	EOT	036	24	00100100	$	068	44	01000100	D	100	64	01100100	d
005	05	00000101	ENQ	037	25	00100101	%	069	45	01000101	E	101	65	01100101	e
006	06	00000110	ACK	038	26	00100110	&	070	46	01000110	F	102	66	01100110	f
007	07	00000111	BEL	039	27	00100111	'	071	47	01000111	G	103	67	01100111	g
008	08	00001000	BS	040	28	00101000	(	072	48	01001000	H	104	68	01101000	h
009	09	00001001	HT	041	29	00101001	)	073	49	01001001	I	105	69	01101001	i
010	0A	00001010	LF	042	2A	00101010	*	074	4A	01001010	J	106	6A	01101010	j
011	0B	00001011	VT	043	2B	00101011	+	075	4B	01001011	K	107	6B	01101011	k
012	0C	00001100	FF	044	2C	00101100	,	076	4C	01001100	L	108	6C	01101100	l
013	0D	00001101	CR	045	2D	00101101	-	077	4D	01001101	M	109	6D	01101101	m
014	0E	00001110	SO	046	2E	00101110	.	078	4E	01001110	N	110	6E	01101110	n
015	0F	00001111	SI	047	2F	00101111	/	079	4F	01001111	O	111	6F	01101111	o
016	10	00010000	DLE	048	30	00110000	0	080	50	01010000	P	112	70	01110000	p
017	11	00010001	DC1	049	31	00110001	1	081	51	01010001	Q	113	71	01110001	q
018	12	00010010	DC2	050	32	00110010	2	082	52	01010010	R	114	72	01110010	r
019	13	00010011	DC3	051	33	00110011	3	083	53	01010011	S	115	73	01110011	s
020	14	00010100	DC4	052	34	00110100	4	084	54	01010100	T	116	74	01110100	t
021	15	00010101	NAK	053	35	00110101	5	085	55	01010101	U	117	75	01110101	u
022	16	00010110	SYN	054	36	00110110	6	086	56	01010110	V	118	76	01110110	v
023	17	00010111	ETB	055	37	00110111	7	087	57	01010111	W	119	77	01110111	w
024	18	00011000	CAN	056	38	00111000	8	088	58	01011000	X	120	78	01111000	x
025	19	00011001	EM	057	39	00111001	9	089	59	01011001	Y	121	79	01111001	y
026	1A	00011010	SUB	058	3A	00111010	:	090	5A	01011010	Z	122	7A	01111010	z
027	1B	00011011	ESC	059	3B	00111011	;	091	5B	01011011	[	123	7B	01111011	{
028	1C	00011100	FS	060	3C	00111100	<	092	5C	01011100	\	124	7C	01111100	¦
029	1D	00011101	GS	061	3D	00111101	=	093	5D	01011101	]	125	7D	01111101	}
030	1E	00011110	RS	062	3E	00111110	>	094	5E	01011110	^	126	7E	01111110	~
031	1F	00011111	US	063	3F	00111111	?	095	5F	01011111	_	127	7F	01111111	DEL

Appendix 8: Microcomputer Literature

AARDVARK JOURNAL
Aardvark Technical Services
52 South Commerce
Walled Lake, MI 48088

ACCESS: MICROCOMPUTERS IN LIBRARIES
DAC Publications
76475 LaDuke Street
Oakridge, OR 97463
$11.00/YR Quarterly 9277-0784

APPLE
Apple Computer, Inc.
10260 Bandley Drive
Cupertino, CA 95014

APPLE ORCHARD
International Apple Core
P.O. Box 976
Daley City, CA 95017

BUSS: THE INDEPENDENT NEWSLETTER OF HEATH COMPANY COMPUTERS
325 Pennsylvania Ave., SE
Washington, D.C. 20003
$8.00/YR Monthly Heath

BYTE
BYTE Publications, Inc.
70 Main Street
Petersborough, NH 03458
$19.00/YR Monthly 0360-5280

CALL A.P.P.L.E.
Apple Puget Sound Program Library Exchange
304 Main Ave. South
Renton, WA 98055

CLASSROOM COMPUTER NEWS
P.O. Box 226
Cambridge, MA 02138
$12.00/YR Bi-monthly

COLOR COMPUTING NEWS
P.O. Box 1192
Muskegon, MI 49443
$9.00/YR Bi-monthly TRS

COMPUTE
P.O. Box 5406
Greensboro, NC 27403
$20.00/YR Monthly

COMPUTER DEALER
Gordon Publishing Company
20 Community Place
Morristown, NJ 07960
0160-8916

COMPUTER
IEEE Computer Society
10662 Los Vaqueros Circle
Los Alamitos, CA 90702
$30.00/YR Monthly 008-9162

COMPUTER DECISIONS
Hayden Publishing Company, Inc.
50 Essex Street
Rochelle Park, NJ 07662
$24.00/YR Monthly 0010-4558

COMPUTER GRAPHIC NEWS
NCGA Suite 330
2033 M Street, NW.
Washington, D.C. 20036

COMPUTER GRAPHICS AND APPLICATIONS
IEEE Computer Society
10662 Los Vaqueros Circle
Los Alamitos, CA 90702
0272-1716

COMPUTER GRAPHICS WORLD
Cygnus Publications, Inc.
54 Mint Street
San Francisco, CA 94103

COMPUTER MERCHANDISING
Eastman Publishing Company, Inc.
15720 Ventura Blvd.
Suite 610
Encino, CA 91436

COMPUTER PRODUCTS
Gordon Publishing Company, Inc.
1101 San Antonio Road, Suite 3
Mountain View, CA 91436
0161-6862

COMPUTER RETAILING
W.R.C. Smith Publishing
1760 Peachtree Road
N.W. Atlanta, GA 30357

COMPUTERS AND EDUCATION
Pergamon Press, Inc.
Maxwell House
Fairview Park
Elmsford, NY 10523
$95.00/YR Quarterly 0360-1315

COMPUTERS 82
1515 Broadway
New York, NY 10036
Quarterly

COMPUTING TEACHER, THE
Computer Science Department
University of Oregon
Eugene, OR 97403
$14.50/YR 9, Issues Annually

COMPUTRONICS
20 North Pascack Road
Spring Valley, NY 10977
TRS

CREATIVE COMPUTING
P.O. Box 789-M
Morristown, NJ 07960
$20.00/YR Monthly 0097-8140

DATA COMMUNICATIONS
McGraw-Hill, Inc.
1221 Avenue of America
New York, NY 10020
$18.00/YR Bi-monthly 0363-6399

DATA DECISIONS
20 Brace Road
Cherry Hill, NJ 08034

DATA CAST
Wirelist Digital, Inc.
345 Swett Road
Woodside, CA 94062

DATA MANAGEMENT
505 Busse Hwy.
Park Ridge, IL 60068
$16.00/YR Monthly 0148-5431

DATA SOURCES
Ziff-Davis Publishing
20 Brace Road
Cherry Hill, NJ 08034

DATAMATION
Technical Publishing
666 Fifth Ave.
8th Floor
New York, NY 10103
$36.00/YR Monthly 0011-6963

DESKTOP COMPUTING
Wayne Green, Inc.
90 Pine Street
Peterborough, NH 03458

DIGITAL DESIGN
Benwill Publishing Corp.
1050 Commonwealth Ave.
Boston, MA 02215
$20.00/YR Monthly 0147-9245

DR. DOBB'S JOURNAL (Of Computer Calisthenics and Orthodontia)
Peoples Computer
Box E
1263 El Camino Real
Menlo Park, CA 94025
$12.00/YR Monthly 0190-1435

EDN
Cahners Publishers Company
221 Columbus Ave.
Boston, MA 02116

EDUCATIONAL COMPUTER MAGAZINE
P.O. Box 535
Cupertino, CA 95015
$12.00/YR Bi-monthly

80 CONTENTS

80 U.S.
80 Northwest Publishing, Inc.
80 U.S. Journal
3838 S. Warner Street
Tacoma, WA 93409

ELECTRONIC LEARNING
902 Sylvan Ave.
Englewood Cliffs, NJ 07632
$17.00/YR Bi-monthly

ELECTRONIC NEWS
Fairchild Publications, Inc.
7 East 12th Street
New York, NY 10003
$22.00/YR Weekly 0013-4937

ELECTRONICS
McGraw-Hill Building
1221 Avenue of Americas
New York, NY 10020
$18.00/YR Fortnightly 0013-5070

HOME AND EDUCATIONAL COMPUTING
P.O. Box 5406
Greensboro, NC 27403
$10.00/YR Bi-monthly Commodore

IEEE MICRO
IEEE Computer Society
10662 Los Vaqueros Circle
Los Alamitos, CA 90702

INFO AGE
211 Consumers Road
Willodale, Ontario, Canada M2J 4G8
$20.00/YR Monthly

INFO SYSTEMS
Hitchcock Publishing
Hitchcock Building
Wheaton, IL 60187
$30.00/YR Monthly 0364-5533

INFOWORLD: NEWS FOR MICROCOMPUTER USERS
375 Cochituate Road
Box 880
Framington, MA 01701
$25.00/YR Weekly 0199-6649

INTERFACE AGE
McPheters, Wolfe, and Johe
16704 Marquardt Ave.
Cerritos, CA 90701
$18.00/YR Monthly 0147-2992

KILOBAUD MICROCOMPUTING TO MICROCOMPUTING
80 Pine Street
Peterborough, NH 03458
$25.00/YR Monthly

LEGAL AUTOMATION NEWS
1730 North Lynn Street
Suite 400
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